NWB3PAN

Nunavut

Department of Public Works and Services

CONSTRUCTION TENDER & CONTRACT SPECIFICATION

Project No.:

PWS: 4-002-450
BCA: 6535
FSC: 2001-7140

Project:

Sewage Treatment Plant Pangnirtung, Nunavut

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FSC GROUP

FERGUSON SIMEK CLARK
ENGINEERS AND ARCHITECTS

TRANSMITTAL

FERGUSON SIMEK CLARK
GROUP
ENGINEERS AND ARCHITECTS

To: CG& T	**Date:** April 30, 2002
	Project: Pangnirtung Sewage Treatment Plant
	Project No.: 2001-7140
Attention: David Parker	**Transmitted by:**
	Mail ☐ **Courier** ☐ **Hand** ☒
	Other ☐

cc:

No. of Copies	Drawing No.	Description
1		Construction Tender and Contract
1		Specification
		Issue for tender April 2002

Remarks:

Per: **Title:**

Building 1052, P.O. Box 1779, Iqaluit, NT, X0A 0H0, Ph: (867) 979-0555 Fx: (867) 979-5711

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PART 1 - GENERAL

1.1 Related Instruction

.1 Comply with Instructions to Tenderers.

1.2 Intent

.1 The intent of this bid call is to obtain an offer to perform work to complete the Construction of the New Sewage Treatment Plant in the community of Pangnirung, Nunavut for a Stipulated Price contract, in accordance with the Contract Documents.

.2 This Baffin Region project is located in the Hamlet of Pangnirtung on the east shore of Cumberland Sound on Baffin Island, northeast of Iqaluit.

.3 Transportation links are by scheduled air services from Yellowknife, Ottawa and Montreal via Iqaluit and by an annual summer sealift from Montreal.

1.3 Examination

.1 Examine Tender Documents and report to Architect any discrepancies, omissions, errors, departure from building by-laws or good practice and points considered to be dubious of intent, so that Architect may, if he considers it desirable, issue instructions by Addendum.

.2 Examine all conditions relating to the work and determine the nature and location of the work, local conditions, soil structure and topography at the site, the equipment and facilities needed preliminary to and during the prosecution of the work, the means of access to the site, accommodation, all necessary information as to risks, limitations, contingencies and circumstances which may affect the Tender, and all other matters which can in any way affect the work.

1.3 Examination (Cont'd)	.3	Contractors are required by the standard general conditions of construction contracts to perform work and to furnish materials and equipment that could reasonably be inferred from the contract documents, or from prevailing custom or trade practices, as being required to produce the intended result whether or not specifically designated. The contract documents are to be read as a complete document. Any work required by a trade clearly indicated in any part of the documents is deemed the responsibility of that trade. No additional claims will be entertained for bidders reading only their specific sections of the contract documents.
	.4	Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained prior to Tender closing date.
1.4 Subsurface	.1	Subsurface investigations by AGRA Earth & Environmental dated August 2001 as well as a subsequent desk study dated January 30, 2002 are included(Refer to Section 00225).
1.5 Schedule and Sequence of Work	.1	Tenderers are required to submit with their Tender a tentative schedule showing proposed starting and completion times of all major parts and trades of the work together with a proposed cash flow chart indicating Contractor's anticipated monthly progress billings from commencement of work to completion.
	.2	The project is to be substantially complete by March 31st, 2003.
1.6 Questions	.1	Techincal Questions arising during Tender Period shall be directed to the following: .1 **Robert Billard,** Ferguson Simek Clark Engineers & Architects, Iqaluit, Noble House,

1.6 Questions (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

Building 1088C, P.O. Box 1779 Iqaluit, Nunavut, X0A 0H0. Tel: (867)979-0555 Fax:(867)979-5711, email: (robertb@fsc.ca).

or

.2 **Jason Cole,** Project O fficer, Department of Public Works and Services, P.O. Box 379, Pond Inlet, Nunavut, X0A 0S0, Tel:(867)899-7300, Fax:(867)899-7328, email (jcole@gov.nu.ca).

.2 Questions regarding contractual matters should be directed to:

.1 **MelindaC ole,** Contracts Clerk, Department of Public Works and Services, P.O. Box 379, Pond Inlet, Nunavut, X0A 0S0, Tel:(867)899-7317, Fax:(867)899-7328, email (mcole@gov.nu.ca).

.3 Addenda may be issued during the bidding period. All addenda become part of the Contract Documents. Include costs in the Bid Price.

.1 Verbal answers are only binding when confirmed by written addenda.

.2 Clarifications requested by bidders must be in writing not less than **Seven(7)** days before date set for receipt of bids. The reply will be in the form of an addendum, a copy of which will be forwarded to known bidders no later than **Five(5)** working d ays before receipt of bids.

.4 Product/System Options

.1 Where the Bid Documents stipulate a particular product, alternatives will be considered by the Architect up to 12 days before receipt of bids.

.2 When a request to substitute a product is made, the Architect may approve the substitution and will issue an Addendum to known bidders.

.3 In submission of alternatives to products specified, bidders shall include in their bid, any changes required in the work to accommodate such alternatives. A later claim

1.6 Questions (Cont'd)

.4 (Cont'd)

.3 (Cont'd)

by the bidder for an addition to the contract price because of changes in work necessitated by use of alternatives shall not be considered.

END

1.1 Geotechnical Report

.1 Copies of detailed geotechnical investigation reports are included herein as follows:
.1 Geotechnical Investigation, Proposed Sewage Treatment Plant, Pangnirtung, Nunavut, August 2001 by AMEC Earth & Environmental Limited, Reference No. YX00647.
.2 Geotechnical Desk Study, Sewage Treatment Plant - West Site, Pangnirtung, Nunavut, 30 January 2002, by AMEC Earth & Environmental Limited, Reference No. YX00647.

.2 This report records properties of the soils and recommendations for the design of the foundations, prepared primarily for the use of the consultant. The recommendations given shall not be construed as a requirement of this contract unless also contained in the Contract Documents.

.3 The report, by its nature, cannot reveal all conditions that exist or can occur on the site. Should subsurface conditions be found to vary substantially from the report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the contract price accruing to the owner.

END

GEOTECHNICAL INVESTIGATION
PROPOSED SEWAGE TREATMENT PLANT
PANGNIRTUNG, NU

Submitted to:

Ferguson Simek Clark Engineers and Architects
Yellowknife, NT

Submitted by:

AMEC Earth & Environmental Limited
Yellowknife, NT

August 2001

YX00647

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1.0 INTRODUCTION

Presented herein are the results of the geotechnical investigation conducted at the proposed Sewage Treatment Plant site in Pangnirtung, NU. The purpose of this report is to summarize the results of the geotechnical investigation, and to provide recommendations for the foundation of the proposed development.

1.1 TERMS OF REFERENCE / SCOPE OF WORK

At the request of Mr. Pavol Kavicky, on behalf of Ferguson Simek Clark Engineers and Architects (FSC), AMEC Earth & Environmental Limited (AMEC) conducted a geotechnical investigation at the site of the proposed Sewage Treatment Plant in Pangnirtung, NU. Authorization to proceed with the investigation was received from Mr Pavol Kavicky via a faxed letter sent on June 4, 2001 (FSC file number: 2001-7140).

The purpose of the investigation was to assess the subsurface conditions at the site and to provide recommendations for the design and construction of foundations for the above noted project.

In accordance with the FSC Request for Proposal and the AMEC proposal of May 29, 2001, the scope of work is summarized as follows:

- conduct a review of available aerial photographs and relevant geotechnical information;
- conduct a field investigation that includes the drilling four boreholes over the proposed site, and collecting ground temperature data;
- conduct laboratory analyses of selected soil samples collected during the field drilling, and;
- prepare a report describing the results of the field and laboratory program and provide recommendations with respect to the geotechnical design and comments about construction of the proposed new structure, and any site improvements if required.

2.0 REVIEW OF EXISTING INFORMATION

Previous investigations and other available documentation with respect to geotechnical and climate information of the community of Pangnirtung were reviewed by AMEC. The information is presented below.

2.1 PREVIOUS SUBSURFACE INVESTIGATION REPORTS

The following reports were reviewed by AMEC prior to conducting the geotechnical investigation:

New Firehall Building Geotechnical Investigation, Proposed New Firehall Building, Pangnirtung, NU, Livingstone Architect, March 2001, AMEC Earth & Environmental Limited.

New Attagoyuk School Foundation Soils Investigation, Proposed New Attagoyuk School, Pangnirtung, NU, GNWT Department of Public Works and Services, April, 1997, A GRA Earth & Environmental Limited.

New Fisheries Building Geotechnical Investigation, Proposed New Fisheries Building, Pangnirtung, NU, Pangnirtung Fisheries Ltd., December, 1992, AMEC Earth & Environmental Limited.

Saline Permafrost Distribution of Saline Permafrost in the Northwest Territories, Technical Paper No. 38, Hivon EG and Sego DC, Canadian Geotechnical Conference, 1991

In addition, air photographs 28221-73 and 31700 - 40 were reviewed.

2.2 CLIMATE

Pangnirtung is located on the southeast side of the Pangnirtung Fjord within the Cumberland Peninsula of Baffin Island at approximately 66° 09' N latitude and 65° 45' W longitude. Climate records for Pangnirtung were not available, however, climate data for Pangnirtung was estimated using records for Broughton Island and Iqaluit. The average thawing and freezing indices for Pangnirtung are estimated to be about 400 and 4200 °C-days respectively. The estimated average annual mean temperature is about -11 °C for the period 1961 to 1990.

2.3 GEOLOGY

The community is situated on a narrow beach, and is bounded by the ocean to the northwest and steep mountains to the southeast. Bedrock found in this area is largely of metamorphic origin and is heavily jointed and faulted. Bedrock outcrops are common along the beaches adjacent to the hamlet as well as on the slopes to the southeast.

Surficial soil predominantly consists of sandy glacial till which may have been extensively reworked when the water levels in the Fiord were higher. The sandy till has been reported to contain cobble and boulder size material.

2.4 PERMAFROST

Pangnirtung lies within the zone of continuous permafrost. The depth of seasonal thaw has been reported to vary from about 0.5 m to 1.5 m. Ground temperature data collected at other site in the community suggest that the ground temperature is about –6 °C to –8 °C at depths of 6 m to 10 m.

2.5 SALINITY

Salinity values in the Pangnirtung area have been reported to vary from low to very high (up to 208 ppt at low moisture contents). Reports reviewed tend to indicate the salinity values near the project site range from low to moderate salinity. Low salinity is considered to be less than

about 5 ppt and moderate salinity is considered to be between 5 and 15 ppt. Salinity values in general have been noted to increase with depth.

3.0 FIELD AND LABORATORY PROGRAMS

3.1 FIELD INVESTIGATION

The field drilling was conducted on June 7, 2001, under the supervision of Mr. Ali Sharif, of AMEC's Yellowknife office. Four boreholes (designated as 647-01 to 647–04) were drilled using an air track drill equipped with a 141 mm diameter down-hole pneumatic hammer. The drilling equipment was owned and operated by Canadrill Ltd. of Iqaluit, NU. Boreholes were drilled to a depth of 8.6 to 9.4 m below existing grade. Figure 1 (Appendix A) shows the borehole locations relative to existing buildings near the airport.

The various soil strata of the boreholes were logged during the drilling operation, and the subsoil profiles are shown on the logs presented in Appendix B. The soil samples and cuttings were classified in accordance with the Modified Unified Soil Classification System, described in Appendix B. Classification of frozen soil conditions noted in the borehole logs are described in Appendix B. Samples of the drill cuttings were retained at regular intervals for further classification and testing.

One thermistor was installed in BH647-01 to collect ground temperature data.

It should be noted that the stratigraphic boundaries noted on the borehole logs are approximate (± 0.25 m) due to the method of drilling.

3.2 LABORATORY PROGRAM

A laboratory testing program was performed on selected samples to determine the natural moisture content (M.C.) and the salinity of soil porewater. The results of these tests are discussed in subsequent sections of this report and are shown on the borehole logs. An explanation of the terms and symbols used on the logs is presented in Appendix B.

4.0 SITE CONDITIONS

4.1 SITE DESCRIPTION

The proposed site is located about 1,850 m northeast of the air terminal building. The project site is bounded by a road to the southeast, and undeveloped land on the other three sides. An old incinerator building is located on the site. It had been reported that the building footprint of the incinerator building was about 18.2 m by 12.2 m.

At the time of the investigation, ponded water was noted at the northeast and northwest sides of the site. In general, the site sloped down toward the northwest. Old building supplies and refuse were randomly located around the building on the project site.

4.2 SUBSURFACE CONDITIONS

To the depths investigated, the general stratigraphic profile was observed to consist of a potential fill layer up to 1.5 m thick overlying fine to coarse silty sand with cobbles and boulders. A layer of clayey silt, approximately 1.4 m thick was observed to be overlying the silty sand in borehole BH647-01. Occasional ice crystals were reported in some of the borehole cuttings with a discrete ice layer observed in BH 647-03. Bedrock was not observed to the depths investigated.

In general, the natural moisture content of the fill layer was measured to range between 10 and 15 percent, with one sample from borehole BH647-04, at a depth of about 1.5 m reported to be 66 percent. The natural moisture content of the clayey sand layer was reported to range between 4 and 13 percent. One sample taken from the silt layer of borehole BH647-04 was reported to be about 22 percent.

No ground water was observed in the boreholes at the time of the investigation. However, during , following snowmelt or prolonged rainfall, ground water may be present within the active layer. The ground water is expected to be perched above the permafrost table, which is expected to vary from about 1 m to 1.5 m below existing grade depending on surface cover and disturbance.

One sealed PVC tube was installed in Borehole BH647-01 at the completion of drilling to enable monitoring of ground temperatures. The results of ground temperature data collected from Borehole BH647-01 are presented below.

BH647-01	Date Installed: June 7, 2001 Date Recorded: June 8, 2001
Depth (m)	Temperature (°C)
0.3	+0.1
1.3	-0.9
2.3	-4.5
3.3	-6.4
4.3	-7.1
5.3	-6.8
6.3	-6.6
7.3	-6.3
8.3	-5.7
9.3	-6.1

4.3 SALINITY

Eight samples were analysed for soil salinity content. Salinity values were obtained by the electrical resistance method and ranged from 4.0 to 11.7 ppt at a depth between 4.0 m and 9.0 m. Pore water salinity values obtained from selected samples are shown below:

Borehole	Depth (m)	Salinity (ppt, parts per thousand)
BH647-01	8.0	5.4
BH647-01	9.0	11.7
BH647-02	5.5	4.0
BH647-02	7.0	8.3
BH647-03	4.0	5.5
BH647-03	6.0	5.3
BH647-04	7.5	7.5
BH647-04	8.5	7.4

Based on the above salinity values, the soil of the site may be considered to contain low to moderate salinity.

5.0 FOUNDATION RECOMMENDATIONS

5.1 GENERAL

Based on the results of the drilling and laboratory testing programs, and AMEC's previous experience in the community, two foundation alternatives are considered technically feasible for the project envisioned, and are presented here. It is understood that the existing incinerator building is supported on adfreeze piles. It is considered that the technically preferred option would be a piled foundation as this system will likely result in less settlement than an insulted footing system. In addition, it is considered good practice to maintain a consistent foundation system under the entire structure.

Recommendations with respect to each alternative are presented in the following sections.

5.2 ADFREEZE PILES

Adfreeze piles are on technically feasible foundation type for the proposed construction. Based on the expected soil salinity levels, ice contents, and reported ground temperatures at this site, the adfreeze piles may be designed according to the following values:

Depth of Pile Below Final Grade (m)	Allowable Adfreeze Strength (kPa)
0 – 2	0
2 - 8.5	25
8.5 or more	30

The allowable adfreeze strength is controlled by the creep deformation characteristics of ice-rich permafrost (nominally 25 mm in 25 years). This design capacity is for long term structural loading including snow and permanent occupancy loads. Stresses due to short-term live loads, such as wind and daily occupancy loads in effect for less than 50% of the time (over the short term), may be taken as 30 percent greater than the allowable values given above.

This design assumes a minimum embedment length of 6 metres below the existing ground elevation. The upper portion of the pile within the top two metres below final grade should be coated with heavy grease and wrapped with polyethylene sheets coated with heavy grease (or equivalent) to reduce the potential for pile uplift forces. The upper portion of the pile should also be considered as laterally unsupported for design purposes, including for seismic loading.

The minimum centre-to-centre spacing of the designed adfreeze piles should be 8 pile diameters. If centre-to-centre pile spacing is reduced below 8 pile diameters, group effects may need to be considered. AMEC should be informed and recommendations be revised as required.

Adfreeze piles develop load carrying capacity based on the adfreeze bond between the frozen soil and the pile material. Where steel piles are used, it is essential that the steel pile below the assumed 2 m active zone be properly cleaned and free of paint, lacquer, oil, grease, dirt, and excessive rust to promote the development of a good bond. Round hollow structural section (HSS) steel is recommended as the material for the piles.

Adfreeze piles should be installed open-ended in pre-drilled oversized holes. To obtain proper backfill around a steel pile, it is important to partially backfill about half of the hole with clean sand and fresh water prior to installing the pile. The pile should then be pushed and vibrated down to the bottom of the hole, at the same time, adding more sand and fresh water around the pile hole annulus. A borrow source will be required to supply suitable low saline granular sand.

Steel piles installed in the manner described above will require a pile hole at least 50 mm larger in diameter than the outside diameter of the pile. If it is not considered practical to fill about half of the hole with slurry prior to placing the pile, then the hole diameter should be in the order of 100 mm larger to facilitate good slurry placement. The interior of the piles should be filled with dry, low-saline sand to the final ground elevation to preclude air circulation inside the pile. Consideration should be given to the availability of local drilling equipment when selecting pile dimensions.

Installation of piles is generally easier when the active layer is frozen. During summer or fall, it is possible that accumulations of groundwater in the active layer will cause the holes to collapse or drain into the pile holes, which is technically undesirable. Batter piles can be a particular problem when the active layer collapses. Therefore, it is recommended that the piles be installed between February and April.

Freeze-back around the pile may be expected to occur in about two months if the piles are installed during late winter or early spring. Late summer freeze-back may take longer in order for the full capacity to develop. It is recommended that some initial piles be instrumented with thermistor strings to monitor the freeze-back.

The base of the heated structure should be at least 600 mm above the final grade to permit air circulation under the building. If the full 600 mm air space is not provided, a geothermal analysis should be performed on the foundation system and mitigative measures established to reduce the potential for heat from the structure degrading the permafrost, and thus, seriously reducing the pile capacity. The building owners/operators should be advised that this air space should not be used for storage, and should remain free and unobstructed year round. The air space should not be hoarded.

5.3 INSULATED SPREAD FOOTINGS

Spread footings founded on permanently frozen ground are feasible, even for relatively high loads. Normally such footings are excavated down to the top of the anticipated long-term, post-construction permafrost table. The bearing capacity of spread footings may be more sensitive to changes in the ground temperature profile that adfreeze piles. During excavation, pumps may be required to handle seepage from the active layer. Cobbles and boulders are often encountered in the overburden soils, therefore, a backhoe is recommended for excavation to footing grade. Shallow footings should not be placed on any existing or new fill at the site unless thorough compaction of the fill is ensured.

5.3.1 Insulation Requirements

The level of the permafrost table in the long-term will depend primarily on the final grade level and the amount of insulation (if required) placed around the footings. Based on numerous investigations in the region, the salinity is low to moderate in the upper 2 m of soil below grade. Due to the presence of salinity, an allowance is made for 1°C of freezing point depression, which is considered conservative for the design of shallow foundations.

Figure 3 (Appendix A) shows the amount of insulation required for a range of footing depths below final insulated grade. The depth of the footings below existing grade may vary because of variations in present grades, however, the design is based on a depth below final grade, which should be consistent over the building area. An additional 25 mm of insulation is recommended around any exterior footings along warmer walls, facing between southeast through northwest.

A minimum of 300 mm of sand cover is recommended to protect the insulation. A minimum 600 mm air space is recommended between the top of sand and base of insulated floor. The building owners/operators should be advised that this air space should not be used for storage, and should remain free and unobstructed year round. The air space should not be hoarded. Figure 3 also provides the required lateral extent for the insulation around each footing.

The footing should be placed when the foundation stratum is frozen and the insulation and sand cover must be placed immediately afterwards. If significant thaw occurs below the footing levels during or after the construction settlement may occur, and freezeback may take more than one season, and some frost heave may occur.

Footings constructed with timber or precast concrete should be placed on a thin levelling layer of sand on the frozen foundation stratum. If cast-in-place concrete is to be used, either 300 mm of compacted gravel or 50 mm of extruded polystyrene insulation should be placed to protect the frozen ground from the heat of the curing concrete and visa versa. This insulation should also assist in the proper curing of the concrete.

The footing columns should be covered with greased layers of polyethylene, or equivalent, within the buried portion to reduce the potential for seasonal heaving. The structural connection between footing (including the column) and the structure should be designed to take into account the potential heaving forces and seismic loadings.

5.3.2 Bearing Capacity and Settlement

The bearing capacity of shallow footings on permafrost is limited by the fact that in late summer, the permafrost immediately beneath the footing may be close to thawing. Furthermore, excavation conditions are often less than ideal during the thaw season, with water and sloughing conditions encountered. The allowable bearing capacity for footings placed as described above is 150 kPa.

Settlement of footings on frozen ground is related to size of the footing, ground temperature, ice contents, and salinity. Salinity in the upper strata at the site is not considered critical relative to load distribution and capacity. The design basis is to maintain the ground frozen beneath the footing, even allowing for low salinity. Since the ground will be considerably colder for much of the year, settlement is not expected to be significant.

Some ability to adjust the floor levels at the column tops should be incorporated.

6.0 ADDITIONAL RECOMMENDATIONS

6.1 SITE GRADING AND DRAINAGE

Adequate drainage is required near the building to reduce the potential thermal and physical erosion. A drainage plan should be implemented to drain surface water from the areas adjacent to the proposed building.

For those areas immediately adjacent to the building, design grades should promote rapid drainage and should be sloped a minimum of three (3) percent over a distance of two (2) metres in order to shed water away from the structure.

Downspouts for eaves troughs should be directed away from the building with the discharge point at least 1.5 metres from the exterior of the building. This will reduce the potential for erosion of the subgrade adjacent to the structure. Other areas in the vicinity should be graded to drain at slopes of at least two (2) percent away from the building.

6.2 SUBFLOOR TANKS

If water and sewage storage tanks are to be placed within the crawl space beneath the proposed structure, it is recommended that the tanks be supported by the building piles or on separate piles installed specifically for the tanks. A minimum 600 mm air space is recommended between the final grade elevation and base of the tanks.

If cuts in the existing grade are to be incorporated into the final design, it is recommended that the excavation daylight to one side to allow for positive drainage. If water freezes before draining, an ice dam may form creating an area for water to collect. Further design comments may be provided by AMEC once the configuration of any subfloor tanks are established.

6.3 DESIGN REVIEW AND FOUNDATION MONITORING

It is recommended that a geotechnical review be conducted prior to finalization of design details and contract specifications. This review is considered to be an important part of the design process, as it enables AMEC to be assured that the recommendations contained herein have been understood and interpreted correctly.

Monitoring of the installation of foundation is an integral part of the design process. For adfreeze piles, monitoring must verify continuous water/sand slurry all around the pile for the full frozen depth of embedment. Monitoring of the freeze-back temperatures around the pile is desirable, particularly for summer or fall installations, to confirm that the load bearing capacities are sufficient for the construction schedule.

Compaction testing should be carried out on all engineered fill placement. Proper compaction is important to help minimize the potential for differential settlement.

7.0 CLOSURE

The findings and recommendations presented herein are based on the subsurface conditions observed at the four borehole locations. Should the conditions encountered during construction appear to be different, AMEC Earth & Environmental Limited should be advised immediately and the recommendations contained herein should be revised, if necessary.

The field work described in this report was conducted for the purpose of assessing the geotechnical conditions at this site. Although no environmental contamination was noted during the field work, this does not mean that no such issues are present. If there is any reason to believe that any environmental issues are present at this site, an appropriate environmental assessment should be performed.

This report has been prepared for the exclusive use of Ferguson Simek Clark Engineers and Architects for the specific application described in this report. It has been prepared in accordance with generally accepted permafrost and foundation engineering practices. No other warranty, expressed or implied, is made.

Sincerely,

AMEC Earth & Environmental Limited

REGISTERED PROFESSIONAL ENGINEER
J. M. OSWELL
LICENSEE
N.W.T.

Keith Barnes, B.Sc., E.I.T.
Permafrost Engineer

James M. Oswell, Ph.D., P.Eng
Senior Permafrost Engineer

Reviewed by: Alexandre Tchekhovski, Ph.D. P.Eng.
Permafrost Specialist

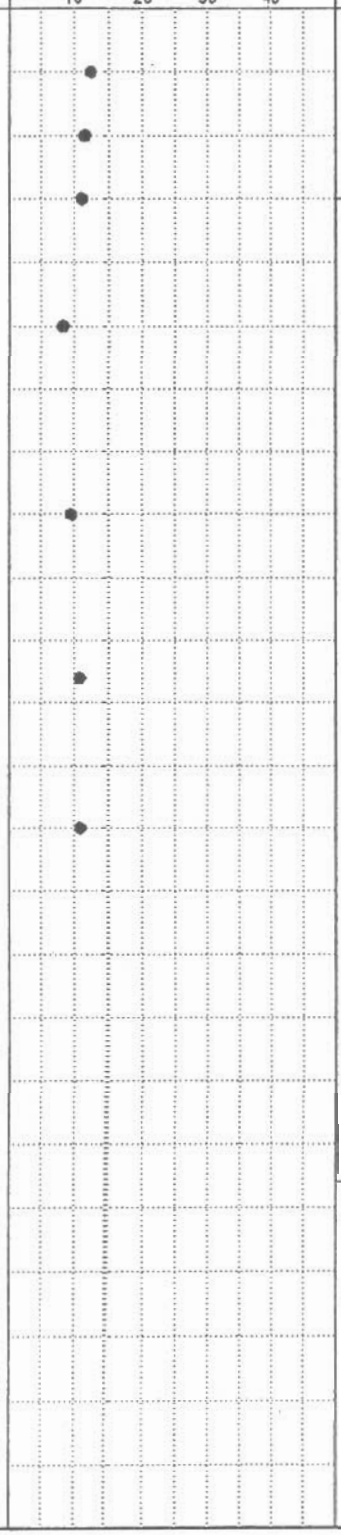
THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
P 047
AGRA Earth & Environmental Limited

Appendix B

Borehole Logs
Explanation of Terms and Symbols
Ground Ice Description

Ferguson Simek Clark	Contractor: Canadrill Ltd.	BOREHOLE NO: BH647-01
Sewage Treatment Plant, Pang.,NU	Equipment: Air Track Drill	PROJECT NO: YX00647
Location: See location plan		ELEVATION:

SAMPLE TYPE ■ Disturbed ☒ No Recovery ☒ SPT Test (N) ☰ Grab Sample ▯ Split-Pen ▮ Core



SOIL DESCRIPTION

FILL
- sandy, trace of gravel and clay, brown, coarse to medium grained, moist when thawed, FROZEN.

SAND
- silty, medium to fine grained, light brown to grey, damp to moist when thawed, FROZEN.

... Cobble between 3.0 m to 3.25 m.

... trace of clay.

... boulder between 6.0 m to 6.35 m.

... boulder between 8.3 m to 8.7 m.

End of Borehole BH647-01 @ 9.3 m.
Thermistor installed to 9.3 m at borehole completion.
Borehole backfilled on completion.

SAMPLE TYPE	SAMPLE NO	COMMENTS
■	1	T = +0.1 C Nbn-Nbe
■	2	Nbn-Nbe
■	3	T = -0.9 C Nbn-Nbe
■	4	T = -4.5 C Nbn
		T = -6.4 C
■	5	Nbn T = -7.1 C
■	6	Nbn-Nbe T = -6.8 C
		T = -6.6 C
■	7	Nbn-Nbe
		T = -6.3 C
■	8	Nbn-Nbe T = -5.7 C
■	9	Nbn-Nbe T = -6.1 C

DEPTH (m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0

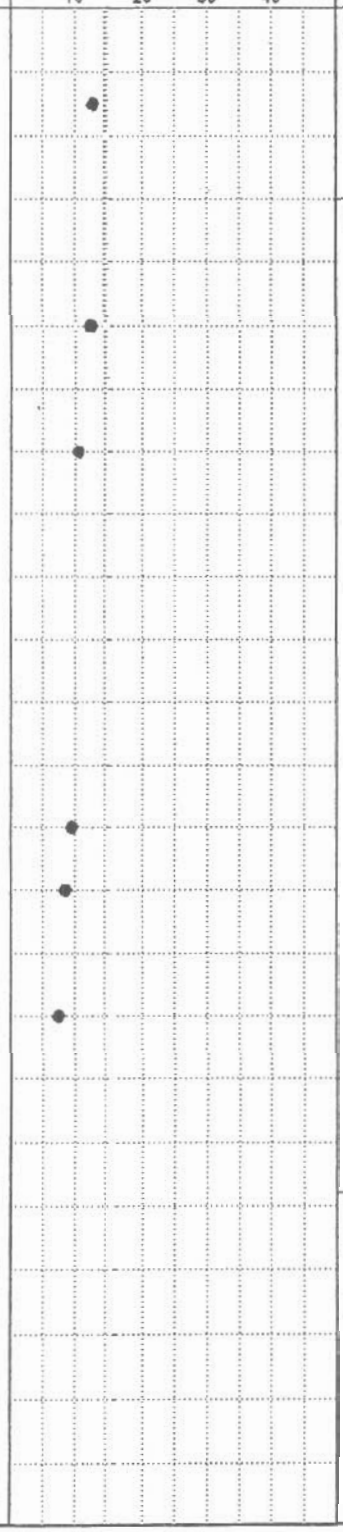
AGRA Earth & Environmental Limited
Edmonton, Alberta

LOGGED BY: ASH	COMPLETION DEPTH: 9.3 m
REVIEWED BY: KB	COMPLETE: 6 /6 /01
Fig. No:	Page 1 of 1

06/25 09:45AM

Ferguson Simek Clark	Contractor: Canadrill Ltd.	BOREHOLE NO: BH647-02
Sewage Treatment Plant, Pang., NU	Equipment: Air Track Drill	PROJECT NO: YX00647
Location: See location plan		ELEVATION:

SAMPLE TYPE ■ Disturbed ▨ No Recovery ▩ SPT Test (N) ▤ Grab Sample ▥ Split-Pen ▮ Core



SOIL DESCRIPTION

FILL
- sandy, some gravel, coarse to medium grained, dark brown, moist when thawed, FROZEN.

SAND
- silty, medium to fine grained, light brown to grey, damp to moist when thawed, FROZEN.

... boulder between 4.1 m to 4.5 m.

... boulder between 5.8 m to 6.4 m.

End of Borehole BH647-02 @ 9.4 m
Standpipe piezometer installed to 9.4 m on borehole completion.
Borehole backfilled on completion.

SAMPLE TYPE	SAMPLE NO	COMMENTS
■	1	Nbn-Nbe
■	2	Nbn-Nbe
■	3	Nbn-Nbe
■	4	Nbn
■	5	Nbn-Nbe
■	6	Nbn
■	7	Nbn
■	8	Nbn

DEPTH (m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0

AGRA Earth & Environmental Limited
Edmonton, Alberta

LOGGED BY: ASH	COMPLETION DEPTH: 9.4 m
REVIEWED BY: KB	COMPLETE: 6 /6 /01
Fig. No:	Page 1 of 1

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Ferguson Simek Clark	Contractor: Canadrill Ltd.	BOREHOLE NO: BH647-03
Sewage Treatment Plant, Pang.	Equipment: Air Track Drill	PROJECT NO: YX00647
Location: See location plan		ELEVATION:

SAMPLE TYPE ■ Disturbed ⊘ No Recovery ⊠ SPT Test (N) ▤ Grab Sample ▥ Split-Pen ◧ Core

DEPTH (m) | ■ STANDARD PEN (N) ■ 20 40 60 80 | PLASTIC M.C. LIQUID 10 20 30 40

SOIL DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	COMMENTS
0.0			ICE
			FILL
			– sandy, trace of gravel and silt, brown, coarse to medium grained, moist when thawed, FROZEN.
1.0			... cobble between 0.75 m to 1.0 m.
			ICE
2.0	■	1	SAND – silty to trace of silt, coarse to fine grained, light brown to grey, humid to moist when thawed, FROZEN. Nbn–Nbe
3.0			... boulder between 2.3 m to 3.0 m.
4.0	■	2	Nbn–Nbe
5.0	■	3	Nbn–Nbe
			... boulder between 5.0 m to 5.6 m.
6.0	■	4	Nf
7.0	■	5	Nbn–Nbe
8.0	■	6	Nbn–Nbe
9.0	■	7	Nbn
			End of Borehole BH647-03 @ 9.3 m. Borehole backfilled on completion.
10.0			
11.0			
12.0			

AGRA Earth & Environmental Limited Edmonton, Alberta	LOGGED BY: ASH REVIEWED BY: KB Fig. No:	COMPLETION DEPTH: 9.1 m COMPLETE: 6 /6 /01 Page 1 of 1

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Ferguson Simek Clark	Contractor: Canadrill Ltd.	BOREHOLE NO: BH647-04
Sewage Treatment Plant, Pang.	Equipment: Air Track Drill	PROJECT NO: YX00647
Location: See location plan		ELEVATION:

SAMPLE TYPE ■ Disturbed ☒ No Recovery ☒ SPT Test (N) ▤ Grab Sample ▥ Split-Pen ▥ Core

DEPTH (m)	STANDARD PEN (N) 20 40 60 80 / PLASTIC M.C. LIQUID 10 20 30 40	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	COMMENTS	DEPTH (m)
0.0		FILL – sandy, some gravel, coarse to medium grained, brown to dark brown, wet to saturated when thawed, FROZEN.				0.0
1.0				1	Nbe, MC=66.0 %	1.0
2.0		SILT – clayey, light brown, wet when thawed, FROZEN.		2	Nbe	2.0
3.0		SAND – silty, medium to fine grained, light brown to grey, damp to moist when thawed, FROZEN.				3.0
4.0				3	Nbn–Nbe	4.0
5.0				4	Nbn–Nbe	5.0
6.0				5	Nbn	6.0
7.0				6	Nbn–Nbe	7.0
8.0				7	Nbn	8.0
9.0		End of Borehole BH647-04 @ 8.6 m. Borehole backfilled on completion.				9.0
10.0						10.0
11.0						11.0
12.0						12.0

AGRA Earth & Environmental Limited Edmonton, Alberta	LOGGED BY: ASH	COMPLETION DEPTH: 8.6 m
	REVIEWED BY: KB	COMPLETE: 6 /6 /01
	Fig. No:	Page 1 of 1

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EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation test	*ST	Swelling test
D_R	Relative density (formerly specific gravity)	TV	Torvane shear strength
Fines	Percentage by weight smaller than #200 sieve	VS	Vane shear strength (undisturbed-remolded)
k	Permeability coefficient	w	Natural water content (ASTM D 2216)
*MA	Mechanical grain size analysis and hydrometer test	w_l	Liquid limit (ASTM D 423)
		w_p	Plastic limit (ASTM D 424)
N	Standard penetration test (CSA A119.1-60)	ε_f	Unit strain at failure
N_d	Dynamic cone penetration test	γ	Unit weight of soil or rock
NP	Non plastic soil	γ_d	Dry unit weight of soil or rock
pp	Pocket penetrometer strength	ρ	Density of soil or rock
*q	Triaxial compression test	ρ_d	Dry density of soil or rock
q_u	Unconfined compressive strength		
*SB	Shearbox test	→	seepage
SO_4	Concentration of water-soluble sulphate	▼	observed water level

**The results of these tests usually are reported separately*

SOIL CLASSIFICATION AND DESCRIPTION

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System[1] modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The use of modifying adjectives may be employed to define the actual or estimated percentage range by weight of minor components. This is similar to a system developed by D.M. Burmister.[2]

The soil classification system is shown in greater detail on page 2.

SAMPLE TYPE — The type of sample is shown at the appropriate depth interval using the following abbreviations:

- A auger sample
- B block sample
- C rock core, or frozen soil core
- D drive sample/SPT sample
- P pitcher tube sample
- U tube sample (usually thin-walled)
- W wash or air return sample
- O other (see report text)
- ⊠ indicates no sample recovery

1. "Unified Soil Classification System", Technical Memorandum 3-357 prepared for Office, Chief of Engineering, by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army. Vol 1, March 1953.
2. American Society for Testing and Materials. Procedures for Testing Soils, "Suggested Methods of Testing for Identification of Soils", 4th Ed; pp 221-233, Dec. 1964.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 200 SIEVE)	GRAVELS MORE THAN HALF COARSE GRAINS LARGER THAN NO 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		WELL GRADED GRAVELS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 4$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			GP		POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
	SANDS MORE THAN HALF FINE GRAINS SMALLER THAN NO 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 6$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			SP		POORLY GRADED SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (WITH SOME FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE P.I. LESS THAN 4
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES 200 SIEVE)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (see below)	
		$W_L > 50\%$	MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS		
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART, NEGLIGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		$30\% < W_L < 50\%$	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L > 50\%$	CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS BELOW "A" LINE ON CHART	$W_L < 50\%$	OL		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINE CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY	
		$W_L > 50\%$	OH		ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE	

SPECIAL SYMBOLS

BEDROCK (Undifferentiated)

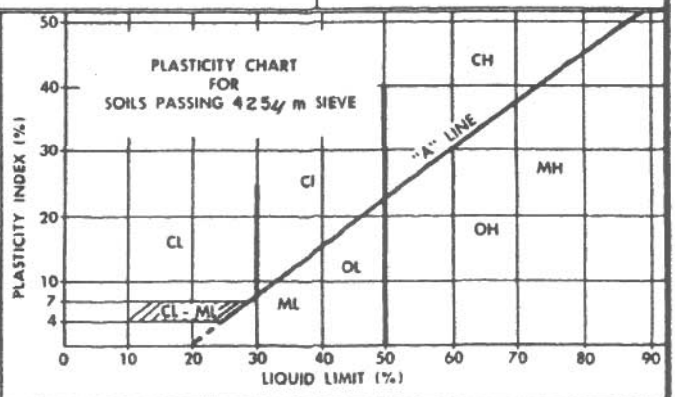
VOLCANIC ASH

SOIL COMPONENTS

FRACTION	U S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL			50 - 35	and
coarse	75 mm	19 mm		
fine	19 mm	4.75 mm	35 - 20	some
SAND				
coarse	4.75 mm	2.00 mm	20 - 10	little
medium	2.00 mm	425μ m		
fine	425μ m	75μ m	10 - 1	trace
SILT (non plastic) or CLAY (plastic)	75μ m			

OVERSIZE MATERIAL

Rounded or subrounded	Not rounded
COBBLES 75 mm to 200 mm	ROCK FRAGMENTS > 75 mm
BOULDERS > 200 mm	ROCKS > 0·76 cubic metre in volume



1. ALL SIEVE SIZES MENTIONED ON THIS CHART ARE U.S. STANDARD, A.S.T.M. E.11.
2. BOUNDARY CLASSIFICATIONS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER BETWEEN 5% AND 12%.

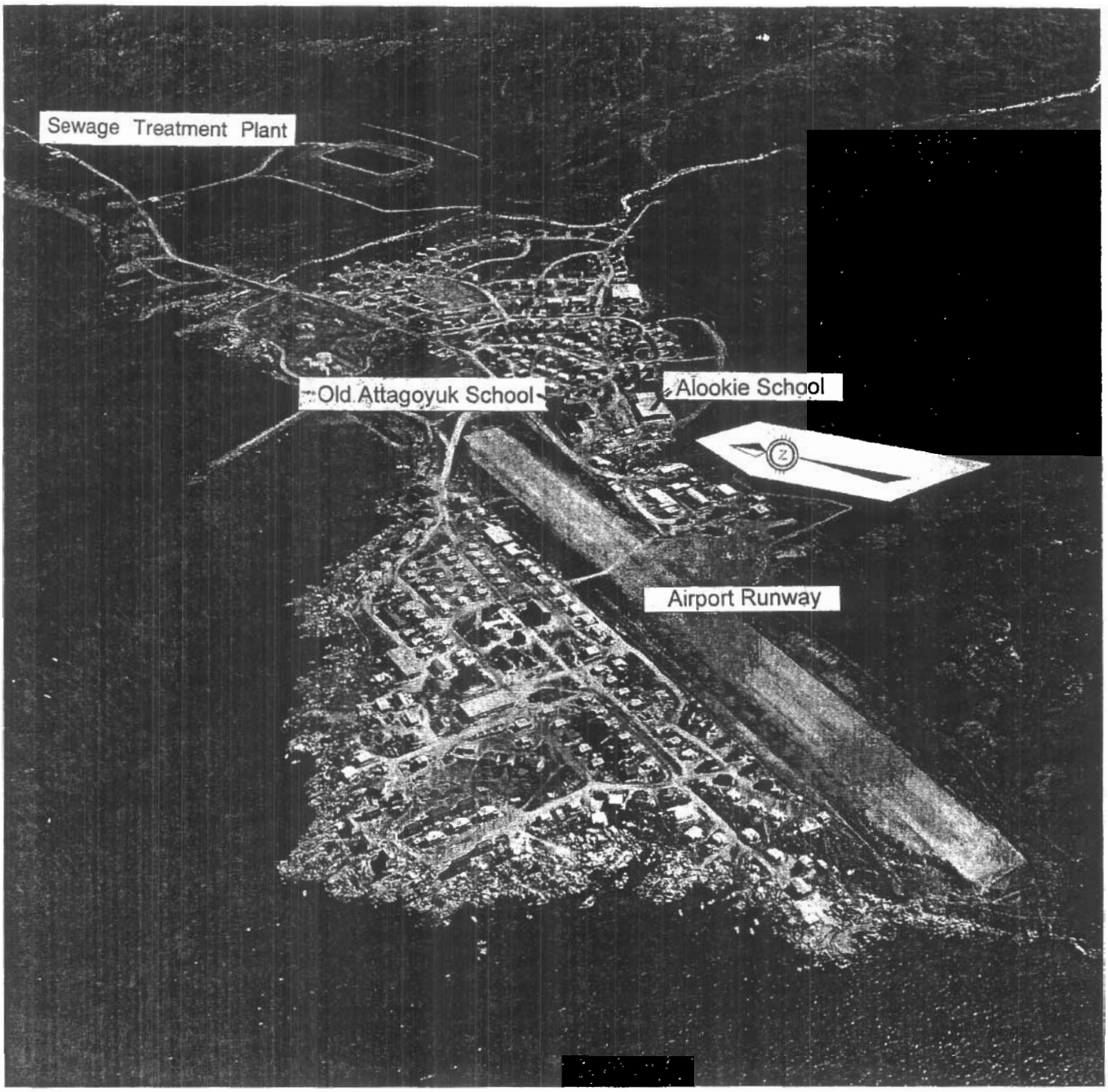
amec

Ground Ice Description

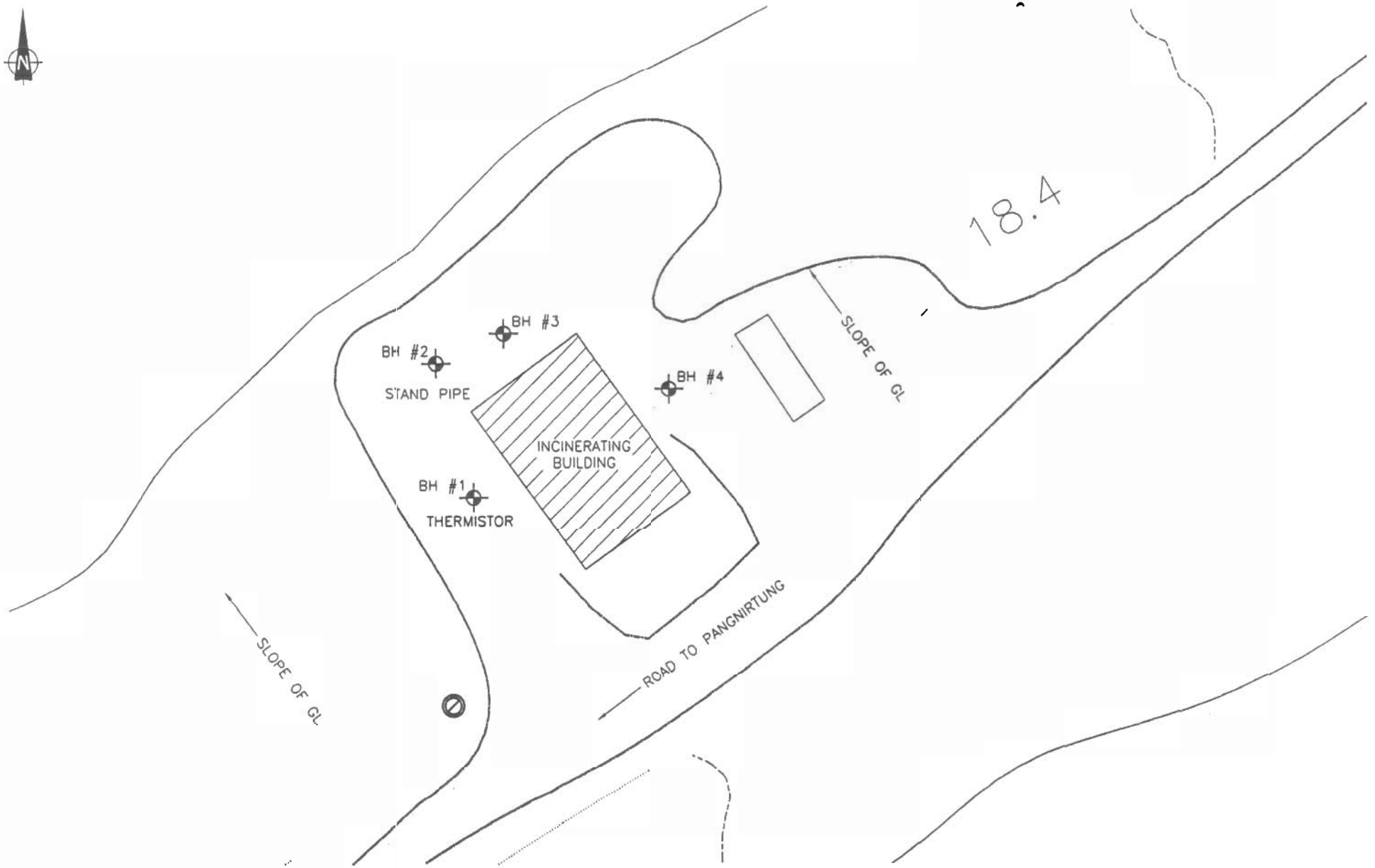
Category	Group Symbol	Subgroup Symbol	Description
Non-Visible	N	NF	Poorly bonded or friable frozen soil
		Nbn	Well bonded frozen soil with no excess ice
		Nbe	Well bonded frozen soil with excess ice
Visible Ice less than 25 mm thick	V	Vx	Individual ice crystals or inclusions
		Vc	Ice coating on particles.
		Vr	Random or irregular oriented ice formations
		Vs	Stratified or distinctly oriented ice formations.
Visible Ice greater than 25 mm thick	ICE + or ICE	ICE + "Soil Type"	Ice greater than 25 mm thick with soil inclusions
		ICE	ICE greater than 25 mm thick without soil inclusions

APPENDIX A

Figure 1:	**General Location Plan**
Figure 2:	**Borehole Location Plan**
Figure 3:	**Insulation Requirement**



		Client: Ferguson Simek Clark Engineers and Architects		
		Proposed Sewage Treatment Plant, Pangnirtung, NU General Location Plan		
Rev	Date: August, 2001	Work Order:	File No: YX00647	Figure 1



SCALE
1: 500
0 5 10 m

AMEC Earth & Environmental Limited

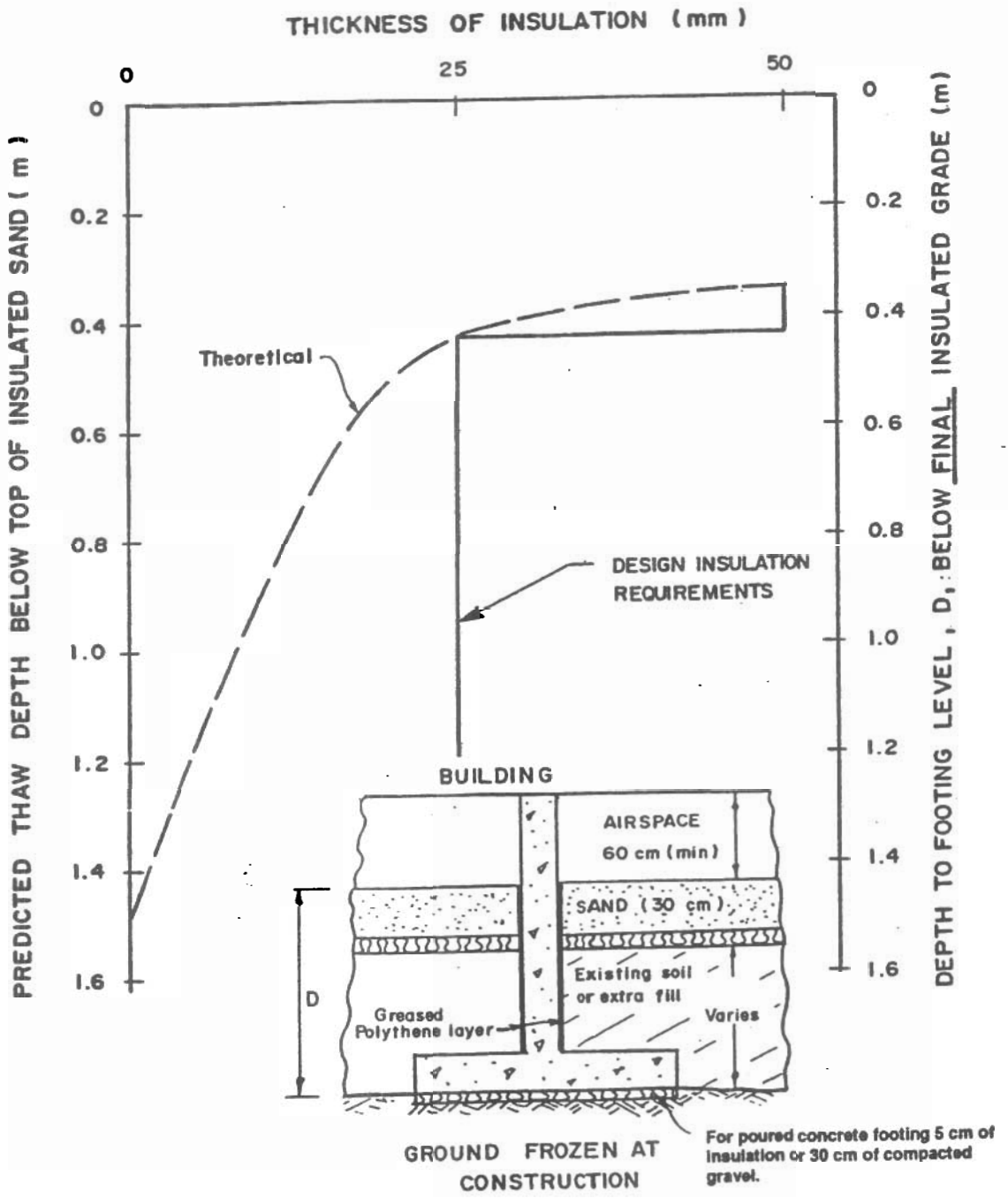
CLIENT: **FERGUSON SIMEK CLARK ENGINEERS AND ARCHITECTS**

PROJECT: **PROPOSED SEWAGE TREATMENT PLANT, PANGNIRTUNG, NU**

TITLE: **BOREHOLE LOCATION PLAN**

DATE:	JOB No.:	CAD FILE:	FIGURE No.:	REV.
AUGUST 2001	YX00647	00647T00.dwg	FIGURE 2	A

PLOT 1:1=A (P)
t:\YX\00647\00647T00.dwg - FIGURE 2 - Aug. 30, 2001 4:26pm - lmontgomery



Notes: Insulation should be extended radially a distance (2.44-D) m beyond the outside edge of all footings.

The thickness of insulation placed around perimeter footings, located on southeast through northwest facing sides of the building should be increased by 25 mm from that determined by the chart.

Insulation should consist of extruded polystyrene.

		Client: Ferguson Simek Clark Engineers and Architects		
		Proposed Sewage Treatment Plant, Pangnirtung, NU Required Insulation for Shallow Footing		
Rev	Date: August, 2001	Work Order:	File No: YX00647	Figure 3

30 January 2002
AMEC Project #: YX00647

Ferguson Simek Clark Engineers and Architects,
P.O. Box 1779, Building 1052,
Iqaluit, NT., X0A 0H0

Fax: 867-979-5712

Attention: Mr. Terry Gray

RE: Geotechnical Desk Study
Sewage Treatment Plant – West Site
Pangnirtung, NU

At the request of yourself on behalf of the Ferguson Simek Clark Engineers and Architects (FSC), AMEC Earth & Environmental Limited (AMEC), has conducted a geotechnical desk study for the new site of the proposed Sewage Treatment Plant in Pangnirtung, NU. Authorization to proceed with the desk study was received verbally from yourself in on January 28, 2002.

1.0 GENERAL

AMEC was requested to conduct a geotechnical desk study based upon readily available published information to determine the likely subsurface conditions near the subject site and to provide foundation recommendations for the project.

The geotechnical discussions presented in this report are based on a review of previous subsurface investigations, air photographs and maps of the area near project site. AMEC has not drilled boreholes at this site nor has a representative of AMEC inspected the project site in the field.

1.0 BACKGROUND INFORMATION

AMEC conducted a geotechnical investigation on the original site for the above noted project on June 7, 2001. Results of the investigation were presented in AMEC's geotechnical report, 'Geotechnical Investigation, Proposed Sewage Treatment Plant, Pangnirtung, NU', dated August 2001.

It is understood that the new proposed site (West Site) for the proposed Sewage Treatment Plant is an undeveloped site and assumed to have no fill. The West Site is adjacent to the west of the previously investigated site. The proposed West Site in general, slopes down to the north at about 5 degrees. A general site plan is shown in Figure 1, Appendix A

It is understood through discussions with FSC, that a slab-on-grade with a thermosyphon cooling system in the gravel pad is considered the preferred foundation alternative. This report will only address a thermosyphon foundation design.

2.0 REVIEW OF EXISTING INFORMATION

Previous investigations and other available documentation with respect to geotechnical and climate information near the project site were reviewed by AMEC. The information is presented below.

2.1 PREVIOUS SUBSURFACE INVESTIGATIONS

The following geotechnical report was reviewed:

- **Geotechnical Investigation, Proposed Sewage Treatment Plant, Pangnirtung, NU**, August 2001, AMEC Earth & Environmental Limited submitted to Ferguson Simek Clark Engineers and Architects

2.1.1 Sewage Treatment Plant

The proposed new site is approximately 30 m west of the previous investigated site for the proposed sewage treatment plant. The general stratigraphic profile from the previous site was reported to consist of a potential fill layer up to 1.5 m thick overlying fine to coarse silty sand with cobbles and boulders. A layer of clayey silt, approximately 1.4 m thick was observed to be overlying the silty sand in one borehole approximately 20 m from the proposed site. Occasional ice crystals/lenses were reported in borehole cuttings. Bedrock was not observed to the maximum --- depth investigated.

In general, the natural moisture content of the fill layer was measured to range between 10 and 15 percent. The natural moisture content of the silty sand layer was reported to range between 4 and 13 percent. A moisture content of 22 percent was recorded from the silt layer

The results of ground temperature data recorded from the site indicate that the ground temperature at a depth of approximately 9 m is about -6°C.

Salinity values were reported to vary between 4 and 11.7 ppt (parts per thousand) at a depth between 4.0 m and 9.0 m.

2.2 GEOLOGY

The community is situated on a narrow terrace, and is bounded by the ocean to the northwest and steep mountains to the southeast. Bedrock found in this area is largely of metamorphic origin and is heavily jointed and faulted. Bedrock outcrops are common along the beaches adjacent to the hamlet as well as on the slopes to the southeast.

Surficial soil predominantly consists of sandy glacial till which may have been extensively reworked when the water levels in the Fiord were higher. The sandy till has been reported to contain cobble and boulder size material.

2.3 CLIMATE

Pangnirtung is located on the southeast side of the Pangnirtung Fjord within the Cumberland Peninsula of Baffin Island at approximately 66° 09' N latitude and 65° 45' W longitude. Climate records for Pangnirtung were not available, however, climate data for Pangnirtung was estimated using records for Broughton Island and Iqaluit. The average thawing and freezing indices for Pangnirtung are estimated to be about 400 and 4200 °C-days respectively. The estimated average annual mean temperature is about -11 °C for the period 1961 to 1990.

2.4 PERMAFROST

Pangnirtung lies within the zone of continuous permafrost. The depth of seasonal thaw has been reported to vary from about 0.5 m to 1.5 m. Ground temperature data collected at other sites in the community suggest that the ground temperature is about –6 °C to –8 °C at depths of 6 m to 10 m.

2.5 SALINITY

Salinity values in the Pangnirtung area have been reported to vary from low to very high (up to 208 ppt at low moisture contents). Low salinity is considered to be less than about 5 ppt and moderate salinity is considered to be between 5 and 15 ppt. Salinity values in general have been noted to increase with depth.

2.6 INFERRED SUBSURFACE CONDITIONS

Based on the review of the published geotechnical information, the following generalized stratigraphy may be encountered at the site:

- A thin layer of grassy peat may be observed at the surface of the site overlying native soils.
- Native soils could be expected to comprise of fine-grained sand with varying amounts of silt and clay. Trace to some gravel and occasional cobbles and boulders may be anticipated.
- Ground temperatures near the site may be anticipated to be about -6°C at a depth of about 9 m.
- The salinity values near the project site range from low to moderate salinity, however, higher salinities exist in the community.

3.0 FOUNDATION RECOMMENDATIONS

The preferred foundation option being considered, a slab-on-grade with a thermosyphon cooling system in the gravel pad, is considered to be a viable foundation alternative for the proposed Sewage Treatment Plant, West Site. The following sections outline various aspects of this design alternative.

3.1 THERMOSYPHON

Thermosyphons have been used successfully in several communities in the NWT. The foundation system is based on a granular pad that is artificially cooled to maintain the permafrost below the gravel pad. The gravel pad is built up with the piping for the

thermosyphons. The piping is then brought vertically up the side of the building and the radiator/condenser supported by the building or the slab. Consideration must be given to possible future expansion when designing for a thermosyphon foundation.

The design of the thermosyphons, the pad and insulation thickness are typically provided by the thermosyphon suppliers. If required, AMEC could conduct geothermal modelling to optimize the thermosyphon design. All installation details should be in strict accordance with the manufacturers specifications. The concrete slab could be placed directly on the insulation.

3.1.1 SITE PREPARATION

Grading may be required to level the site and provide surface drainage. Prior to base levelling pad construction, the subgrade should be checked to detect any extremely soft or loose areas. Any such areas should be over-excavated and replaced with engineered gravel fill. An appropriate engineered fill (75 mm) that could be used for general rough fill is shown Appendix A. Snow and ice must be removed prior to the placement of any fill material.

Ideally, fill placement would commence as soon as the borrow material is unfrozen and the soil can be compacted in an unfrozen state. If significant thaw of the base of the subgrade occurs prior to fill placement, initial settlement of the pad may occur prior to complete freezeback.

An engineered granular pad should be placed directly over the compacted base levelling pad. The pad thickness will be determined by a combination of the following: the minimum fill thickness discussed in subsequent sections, the desired floor level and the slope of the site. The granular pad material should be a well-graded 25 mm crush and contain less than 10 percent fines (material passing 0.075 mm screen). One example of an appropriate 25 mm crush is presented in Appendix A. Other gradations may be appropriate but should be reviewed by a geotechnical engineer. The pad should be thick enough so that the finished floor and the grade within 3 m of the building is greater than 0.3 m above the surrounding grade.

All gravel should be placed in lifts not exceeding 150 mm compacted thickness and compacted to a minimum of 100 percent standard Proctor maximum dry density. No gravel should be placed that is in a frozen state. The crest of the granular pad should extend to 3 metres beyond the exterior perimeter of the building, and beyond that have side slopes that are at least 2H:1V, or flatter.

It is recommended that the gravel pad be instrumented with thermistor strings to monitor freeze-back. A layout could be provided once final subfloor sections are finalized. If necessary to expedite freezeback, the cooling system could be connected to an external mechanical refrigeration system.

3.1.2 INSTALLATION OF UNDERSLAB PIPES AND THERMOSYPHONS

Depending on the type of piping being used, suitable bedding and padding such as sand may be required. Uniform compaction of any bedding or padding, and the gravel below, around and above the ducts is important for the provision of a stable foundation pad. Compaction to 100 percent of standard Proctor density will permit a bearing pressure of 150 kPa.

3.1.3 SUPPORT OF STRUCTURAL LOADS

Structural loads may be supported on a locally-thickened slab, or on a perimeter beam. For design purposes, an allowable bearing pressure of 150 kPa may be assumed for the slab or perimeter beam placed on a granular base uniformly compacted as recommended. There should be a minimum 200 mm of gravel fill pad beneath the thickened edge or grade beam.

3.1.4 EXTERIOR INSULATION

A 50 mm thick layer of extruded polystyrene insulation should extend laterally from the exterior of the building approximately 2 metres. The insulation should be sloped at about five (5) percent away from the building and be covered with a minimum of 200 mm of granular fill on areas not subject to vehicular traffic. Use of higher strength insulation should be considered for areas underlying vehicular traffic.

3.1.5 CONCRETE TYPE

All concrete should be surrounded by relatively clean sand or gravel fill to reduce the risk of sulphate attack. If this is implimented, Type 10 Portland cement may be used. Air entrainment is recommended for all concrete to improve freeze-thaw characteristics of the concrete.

4.0 ADDITIONAL RECOMMENDATIONS AND COMMENTS

4.1 SITE GRADING AND DRAINAGE

Adequate drainage is required near the building to reduce the potential thermal and physical erosion. A drainage plan should be implemented to drain surface water away from the areas adjacent to the proposed building. Special measures may be required to intercept and divert downslope surface run-off and shallow, active layer seepage. An upslope swale should be considered.

For those areas immediately adjacent to the building, design grades should promote rapid drainage and should be sloped a minimum of three (3) percent over a distance of two (2) metres in order to shed water away from the structure.

Downspouts for eaves troughs should be directed away from the building with the discharge point at least 1.5 metres from the exterior of the building. This will reduce the potential for erosion of the subgrade adjacent to the structure. Other areas on the site should be graded to drain at slopes of at least two (2) percent away from the building.

4.2 DESIGN REVIEW

It is recommended that a geotechnical review be conducted prior to finalization of design details and contract specifications. This review is considered to be an important part of the design process, as it enables AMEC to be assured that the recommendations contained herein have been understood and interpreted correctly.

4.3 FOUNDATION MONITORING

Monitoring of the installation of foundations is an integral part of the design process. Compaction testing should be carried out at all phases of construction to confirm that adequate degrees of compaction are obtained. Proper compaction is important to help minimize the potential for differential settlement.

5.0 CLOSURE

The findings and recommendations presented herein are based on a review of AMEC's geotechnical report, 'Geotechnical Investigation, Proposed Sewage Treatment Plant, Pangnirtung, NU', dated August 2001. No drilling was conducted on the new site prior to submission of this report. Should the conditions encountered during construction appear to be different than those noted in the geotechnical report, AMEC Earth & Environmental Limited should be advised immediately and the recommendations contained herein should be revised, if necessary.

This report has been prepared for the exclusive use of the Ferguson Simek Clark Engineers and Architects Ltd and its agents for the specific application described in this report. It has been prepared in accordance with generally accepted permafrost and foundation engineering practices. No other warranty, expressed or implied, is made.

Yours truly,

AMEC Earth & Environmental Limited

REGISTERED PROFESSIONAL ENGINEER
K.G. BARNES
LICENSEE
NWT/NU

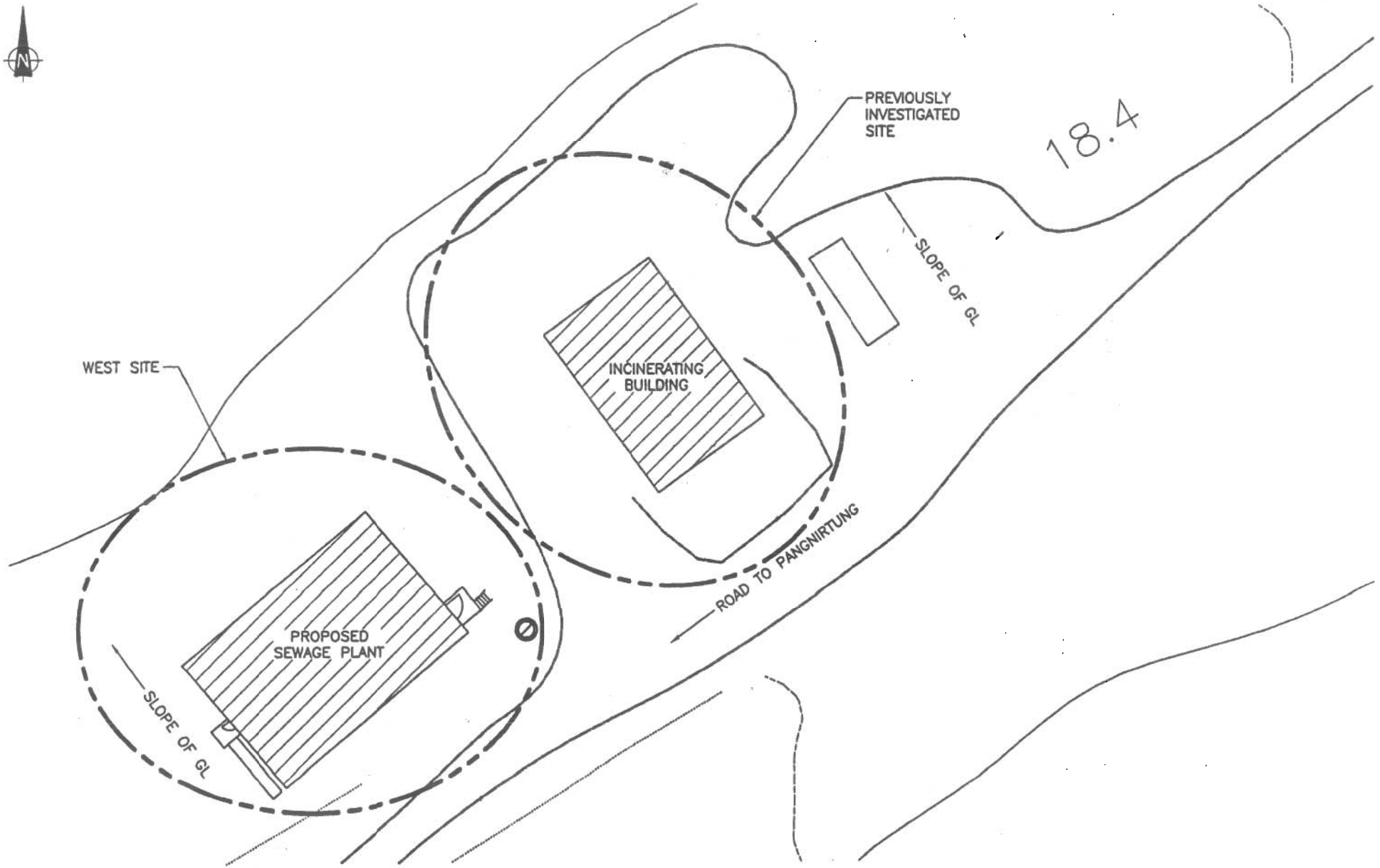
Keith Barnes, P.Eng.,
Permafrost Engineer

PERMIT TO PRACTICE
AMEC Earth & Environmental Limited
Signature
Date Feb. 1 2002
PERMIT NUMBER: P 047
The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU

Reviewed by: Alan J. Hanna, M.A.Sc., P.Eng
Senior Permafrost Engineer

APPENDIX A

Figure 1: General Site Plan
Gradation for Gravels



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AMEC Earth & Environmental Limited

CLIENT: FERGUSON SIMEK CLARK ENGINEERS AND ARCHITECTS

PROJECT: PROPOSED SEWAGE TREATMENT PLANT WEST SITE, PANGNIRTUNG, NU

TITLE: GENERAL SITE PLAN

DATE:	JOB No.:	CAD FILE:	FIGURE No.:	REV.
JANUARY 2002	YX00647	00647T00.dwg	FIGURE 1	A

"PLOT 1:1=A (P)"
t:\YX\00647\00647T00.dwg - FIGURE 2 - Jan. 31, 2002 4:35pm - patrick.robinson

RECOMMENDED GRADATION FOR GRAVEL

25 mm Minus Crushed Gravel	
Sieve Size	**Percent Passing by Weight**
25 mm	100
20 mm	95 - 100
10 mm	60 - 80
4.75 mm	40 - 60
2.36 mm	28 - 48
600 µm	13 - 29
300 µm	9 - 21
150 µm	6 - 15
75 µm	4 - 10

75 mm Minus Screened Gravel	
Sieve Size	**Percent Passing by Weight**
75 mm	100
40 mm	60 - 80
20 mm	40 - 66
10 mm	25 - 54
4.75 mm	15 - 43
2.36 mm	10 - 35
600 µm	5 - 23
150 µm	3 - 12
75 µm	2 – 10

PART 1 - GENERAL

1.1 Description

.1 Work under this Contract consists of the construction of a 320 square metre Sewage Treatment Plant consisting of a pre-engineered building on concrete slab w/ thermosyphons and associated site works.

.2 Work of Contract is not restricted to work within property lines of site, but includes all work required by Contract Documents, both within and outside the property lines.

1.2 General

.1 Comply with requirements of General Conditions.

.2 Division 1 requirements apply to all Sections of Work.

.3 In case of conflict between General Conditions and Division 1 requirements, General Conditions shall govern.

1.3 Definitions

.1 "Owner" means the Government of the Nunavut Territory as defined in the General Conditions.

.2 "Engineer" means an officer or employee of the owner designated by him to perform, designated by the articles of the agreement of his functions, according to the contract.

.3 "Architect" means a person or persons authorized by the Engineer to perform on his behalf any of his functions under the contract as defined in the General Conditions.

1.4 Metric Project

.1 This project is based on The International System of Units (SI). Measurements are expressed in metric (SI) units and depending on the progress made in the various sectors of the industry are either hard or soft converted units.

.2 All metric units specified shall be taken to be the minimum acceptable unless otherwise noted.

.3 It is the Contractor's responsibility to check and verify with manufacturers and suppliers on the availability of materials and products in either metric or imperial sizes.

.4 Where a material or product cannot be obtained in the metric size specified, provide the next larger imperial size available. Where such change affects other aspects of the project it shall be the Contractor's responsibility to coordinate these aspects at no additional cost to the Owner.

.5 Where both metric and imperial sizes or dimensions are shown, the metric size or dimension shall govern.

.6 The Contractor shall advise the Architect of all imperial size system which he intends to employ.

1.5 Responsibility

.1 The Architect will not be responsible for construction means, methods, techniques, sequences or procedures or for safety precautions and programmes in connection with the work. It is Contractor's responsibility to ensure that work is carried out in accordance with Contract Documents.

.2 The undertaking of periodic inspections by the Architect shall not be construed as supervision of actual construction nor make him responsible for providing a safe place for work, visit, use, access, travel or occupancy

1.5 Responsibility (Cont'd)

.2 (Cont'd) by the Contractor, any Subcontractor, supplier or their employees or agents.

.3 Work specified in the Specification has been divided into Technical Sections for the purpose of ready reference. Division of work among Subcontractors and Suppliers is solely the Contractor's responsibility and Architect assumes no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of work.

1.6 Examination

.1 Contractor is held to have examined site of work and surrounding areas as well as Drawings and Specifications prior to entering into a Contract with Owner, and to have fully informed himself as to conditions and limitations under which he will be obligated to operate in performing work.

.2 Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection of the site prior to Tender closing date.

.3 Prior to commencement of any work, make careful examination of previously executed work, existing conditions, levels and dimensions. Promptly advise Architect of unsatisfactory preparatory work and substrate conditions; commencement of work implies acceptance of conditions.

1.7 Transportation and Deliver of Products

.1 Make arrangements and include for all costs for shipping from source, of products to the building site.

.2 Products shall be securely packed, wrapped or crated where required so as to preserve their shape, profile, consistency, finish as fabricated and to allow their incorporation into the work as specified.

1.7 Transportation and Deliver of Products (Cont'd)

.3 Deliver sufficient material to site to allow for expected field and cutting losses and normal waste.

.4 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays are foreseeable, notify the Architect of such, in order that substitutions or other remedial action may be authorized to prevent delay in performance of Work.

1.8 Use of Site

.1 Check means of access and egress, rights and interests which may be interfered with. Do not block roadways, laneways, entrances or exits.

.2 Before commencement of work, Contractor and Architect shall agree on mutually satisfactory locations for such items as temporary offices and material storage areas.

.3 Where encroachment for any reason beyond property lines is necessary, make arrangements with respective property owners.

.4 Take necessary steps to ensure that no damage is caused to existing structures, buildings, foundations, roads, property, utilities, services, during the progress of the work. If, however any damage is caused, repair and make good such damage, at no extra cost to Owner and to the complete satisfaction of the respective property owners or authorities having jurisdiction.

1.9 Utility Systems

.1 Consult with utility companies and other authorities having jurisdiction to ascertain the locations of existing services on or adjacent to site.

.2 Information as to the location of existing services, if shown on the Drawings, does not relieve the Contractor of his responsibility

1.9 Utility Systems (Cont'd)

.2 (Cont'd) to determine the exact number and location of existing services.

.3 Give proper notices for new services as may be required. Make arrangements with authorities and utilities for service connections required and coordinate the exact location.

.4 Pay any charges levied by utilities or authority for work carried out by them in connection with this contract, unless specified otherwise.

.5 Operate and maintain and pay for all utility systems affected by work of this Contract until the building or specified portions thereof have been accepted by the Owner.

1.10 Sleeves, Supports and Fasteners

.1 Furnish, set and secure inserts, hangers, sleeves, fasteners, adhesives, anchors and other supports and fittings required for proper installation of work but not included in other Sections.

.2 Use exposed metal fastenings and accessories of same texture, colour and finish as base metal on which they occur.

.3 Select appropriate type of anchoring and fastening devices and in sufficient quantity and in such manner as to provide positive Wherever possible and unless otherwise permanent anchorage of unit to be anchored.

END

PART 1: GENERAL

1.1 General

.1 Unless otherwise specified, allowance shall cover the cost of materials and equipment delivered and unloaded at the site, and all applicable taxes. The Contractor's handling costs on the site, labour, installation costs, overhead and profit and other expenses shall be included separately in the Contract Sum and not in the allowance.

.2 Where it is specified that an allowance is to include both supply and installation costs, such allowances shall cover the costs of materials and equipment delivered and unload at the site, all applicable taxes, and the Contractor's handling costs on the site, labour and installation costs, and other expenses, except overhead and profit which shall be included separately in Contract Sum.

.3 Allowances for independent inspection and testing shall cover the cost of such services as provided by independent testing agency only. The Contractor's cost for labour, overhead and other expenses shall be included separately in the Tender Price and not in the allowance.

.4 If the cost of the work is covered by allowances, when determined is more or less than the allowance, the Contract Sum shall be adjusted accordingly by Change Order.

.5 The Contractor shall cause the work covered by allowances to be performed for such amounts and by such persons as the Architect may direct.

.6 Expenditures from allowances shall be authorized in writing by the Architect. Trade documents and refunds shall be credited to the Owner, only cash discounts (if any) on account paid by the Contractor before net due date being retained by the Contractor.

1.1 General (Cont'd)

.7 Ensure that allowance and other costs required in connection therewith are included only one in the Contract Sum.

.8 Progress payments for work and material authorized under cash allowances will be made in accordance with the Terms of Payment of Contract.

1.2 Material & Installation Allowance

.1 Include the following cash allowances in Tender Price:

.1 **$25,000.00** for the installation of new pole and power line to new service mast by Nunavut Power Corporation.
.2 **$10,000.00**for the i nstallation of new phone lines to new service mast by NorthwesTel.
.3 **$5,000.00** for Exterior Signage identified in Section 10999.

.2 Material and installation cash allowance shall include and provide payment for:
.1 Net cost of material.
.2 Applicable duties and taxes.
.3 Delivery to site.
.4 Handling at site, including unloading, uncrating, storage and hoisting.
.5 Protection from damage by elements or otherwise.
.6 Labour installation and finishing.
.7 Other expenses required to complete installation.

END

PART 1 - GENERAL

1.1 Lines and Levels

.1 Lay out new work and establish all required lines and levels.

.2 Set up, maintain and protect permanent reference points and provide general dimensions and elevations for all work.

.3 Lay out lines and grades in accordance with Drawings and Specifications and verify dimensions shown on Drawings in the field.

.4 Promptly advise Architect of any discrepancies or conflicts discovered.

1.2 Details and Measurements

.1 Check and verify dimensions wherever referring to existing work. Dimensions, when pertaining to work of another Section, shall be verified with Section concerned. Details and measurements of work which is to fit or conform with work installed shall be taken at site.

.2 Do not scale Drawings. If there is ambiguity, lack of information or inconsistency, immediately consult Architect for directions. Be responsible for extra costs involved through the disregarding of this notice.

.3 Walls, partitions and screens shown on Drawings shall be considered as extending from floor to underside of structural deck unless specifically indicated otherwise on Drawings.

1.3 Location of Fixtures and Services

.1 Location of fixtures, apparatus, equipment, fittings, outlets, conduits, pipes, ducts and services shown or specified, shall be laid out as shown or dimensioned.

.2 Consult with Architect to establish exact location. Any relocation caused by

1.3 Location of Fixtures and Services (Cont'd)

.2 (Cont'd)
Contractor's failure to consult with Architect shall be done by Contractor as part of work at no extra cost.

.3 Where job conditions require reasonable changes in indicated locations and arrangements, make changes at no additional cost to Owner.

.4 Install work in available spaces so as to maintain required clearances and space for other work. Conserve headroom and floor space in all locations.

.5 Run exposed piping, ducts and conduits in straight lines, neatly arranged, parallel to adjacent building surfaces and, where they run in same direction parallel to each other. Review installation of exposed services with Architect prior to start of work.

.6 Except where locations are specifically noted on Drawings, install exposed mechanical and electrical fixtures including outlets, switches, thermostats, panels and other items, located on walls, in orderly and neatly laid out manner, lining up with each other and grouped together where possible. Review installation with Architect prior to start of rough-in work. Relocate at no cost to Owner any work which does not meet this requirement.

END

PART 1 - GENERAL

1.1 Permits, Licenses, Fees

.1 Where permits, licenses and inspection fees are required by authorities having jurisdiction for specified trade function, they shall be obtained by particular Section responsible for that work.

1.2 Building Code, By-Lawsrequireme and Regulations

.1 Carry out work in accordance with nts of the latest edition of the National Building Code of Canada including all amendments and revisions in force.

.2 Comply with requirements, regulations and ordinances of territorial, local and other authorities having jurisdiction.

.3 Where it is necessary to carry out work outside property lines, such as roadways or grading, comply with applicable requirements of local authorities having jurisdiction.

.4 Promptly submit written notice to Architect of observed variance of Contract Documents from requirements of Building Code and authorities having jurisdiction. Assume responsibility for work known to be contrary to such requirements and performed without notifying Architect.

1.3 Safety Requirements

.1 Be governed by pertinent safety requirements of all authorities having jurisdiction particularly the Nunavut Safety Act and Regulations, the Worker's Compensation Act and other applicable regulations.

.2 Do not, in the performance of the work, in any manner endanger the safety or unlawfully interfere with the convenience of the public.

1.4 Propane Storage

.1 Contractors are advised that they are responsible for the proper care and storage of propane cylinders on GN job sites in accordance with the GN Fire Prevention Act.

The penalty for non compliance is up to $10,000.00 fine and/or 1 year jail term.

.2 A copy of the GN Fire Prevention Act is available by contacting:

Fire Marshall
Dept. of Community Government and Transportation, P.O. Box 800 Iqaluit, Nunavut X0A 0H0 W.G. Brown Building - 2nd Floor Phone: (867)975-5300.

1.5 Fire Protection Requirements

.1 Refer to technical Sections of Specifications and Drawings for specified fire protection requirements.

.2 Test methods used to determine fire hazard classification and fire endurance rating shall be as required by National Building Code.

.3 Upon request, furnish to Architect, evidence of compliance with project fire protection requirements.

.4 Materials and components used to construct fire rated assemblies and materials requiring fire hazard classification, shall be listed and labelled, or otherwise approved by fire rating authority. Labelled materials or their packing shall bear ULC label showing opening classification and rating.

.5 Fire rated door assemblies shall include door, frame, frame anchors and hardware and shall bear label of fire rating authority, showing opening classification and rating.

.6 Materials having fire hazard classification shall be applied or installed in accordance with fire rating authority's printed instructions.

1.5 Fire Protection Requirements (Cont'd)

.7 Fire rated assemblies shall be constructed in accordance with applicable fire test report information issued by fire rating authority. Deviation from fire test report will not be allowed.

.8 Construct fire rated assemblies as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from floor to underside of structural deck above.

.9 Fill and patch voids and gaps around openings and penetrations in and at perimeter of fire rated assemblies so as to maintain integrity of fire resistance rating.

1.6 W.H.I.M.S.

.1 Legislation has taken effect as of October 1988 concerning the Workplace Hazardous Materials Information System.

.2 All designated products used on this work shall be labelled with appropriate symbols, risk phases, precautionary and first aid measures required by the regulations.

.3 Additionally each manufacturer will supply a material safety data sheet to the jobsite and these sheets shall be posted in a conspicuous place.

.4 All personnel shall be made aware of these data and recommended precautions shall be observed.

END

When the following abbreviations are used in the Contract Documents, they shall have the meanings shown.

Abbreviation	Meaning
AA	The Aluminum Association
AAMA	Architectural Aluminum Manufacturers' Association
AIMA	Acoustical & Insulating Materials Association
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society of Testing and Materials
AWMAC	Architectural Woodwork Manufacturers' Association of Canada
CCA	Canadian Construction Association
CCRC	Canadian Code for Residential Construction
CEC	Canadian Electrical Code C22.1-1986
CEMA	Canadian Electrical Manufacturers' Association
CGSB	Canadian General Standards Board
CIQS	Canadian Institute of Quantity Surveyors
CISC	Canadian Institute of Steel Construction
CITC	Canadian Institute of Timber Construction
CLA	Canadian Lumbermen's Association
CMHC	Canada Mortgage & Housing Corporation
COFI	Council of Forest Industries of British Columbia
CPCI	Canadian Prestressed Concrete Institute
CRCA	Canadian Roofing Contractors' Association
CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSPI	Corrugated Steel Pipe Institute
CSSBI	Canadian Sheet Steel Building Institute
CUA	Canadian Underwriters' Association
CWB	Canadian Welding Bureau
IES	Illuminating Engineering Society
LTIC	Laminated Timber Institute of Canada
NBFU	National Board of Fire Underwriters
NBC	National Building Code of Canada
NEMA	National Electrical Manufacturers' Association
MFPA	National Fire Protection Association
NLGA	National Lumber Grades Authority
NRCC	National Research Council of Canada
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
RAIC	Royal Architectural Institute of Canada
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters' Laboratories of Canada

END

PART 1 - GENERAL

1.1 Section Includes

.1 Pre-Purchased Equipment.

.2 Responsibilites.

1.2 Pre-Purchased Equipment

.1 Certain items of equipment have been pre-purchased. Refer to Section 15510, Process Equipment.

.2 The purpose for pre-purchasing this equipment is to ensure delivery to the site within the required project completion schedule.

.3 The equipment specifications and shop drawings for the pre-purchased items are included in the project specification.

.4 Receive equipment F.O.B. the high water mark in Pangnirtung, Nunavut and store and process the equipment until installation.

1.3 Responsibilities

.1 Owner Responsibilities:

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.

.2 Deliver supplier's bill of materials to Contractor.

.3 Arrange and pay for delivery to site in accordance with Progress Schedule.

.4 Inspect deliveries jointly with Contractor.

.5 Submit claims for transportation damage.

.6 Arrange for replacement of damaged, defective or missing items.

.7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

1.3 Responsibilities (Cont'd)

.2 Contractor Responsibilities:

.1 Designate submittals and delivery date for each product in progress schedule.

.2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.

.3 Receive and unload products at site.

.4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.

.5 Handle products at site, including uncrating and storage.

.6 Protect products from damage, and from exposure to elements.

.7 Assemble, install, connect, adjust, and finish products.

.8 Provide installation inspections required by public authorities.

.9 Repair or replace items damaged by Contractor or Subcontractor on site (under his control).

.3 Schedule of Pre-purchased items.

.1 See attached purchase orders from the GN.

1.4 Tank Erection

.1 Greatario Engineered Storage Systems were commissioned to fabricate the Equalization Tank and Sludge Digestor Tanks. The fabricator will be required to erect the tanks on site. Contractors are to coordinate material, equipment, labour and incidentals with Greatario.

.1 Contact Information:

Greatario Engineered Storage Systems, P.O. Box 399, Innerskip, Ontario, N0J 1M0, telephone: 519-469-8169; fax: 519-469-8157.

1.5 Process System General -.1 BCA - The Clearwater Group have developed the overall system process and have aided in the procurement of the equipment for the GN and will play a key role in the installtion and commissioning of the process system. All inquiries regarding the process system shall be directed to Richard Johnson, BCA, 14666 - 64th Avenue, Surrey, BC, V3S 1X7, Phone: 604-501-6171, fax: 604-501-6172.

PART 2 - PRODUCTS

2.1 Not Used .1 Not used.

PART 3 - EXECUTION

3.1 Not Used .1 Not used.

END

PART 1 - GENERAL

1.1 Pre-Purchased Equipment

.1 Items specified in this Section have been pre-purchased and will be delivered FOB, Pangnirtung, Nunavut. For additional responsibilities not specified in this Section including unload and warranties refer to Section 01110.

.2 Receive equipment F.O.B. and store and process the equipment until installation.

1.2 Shop Drawings and Product Data

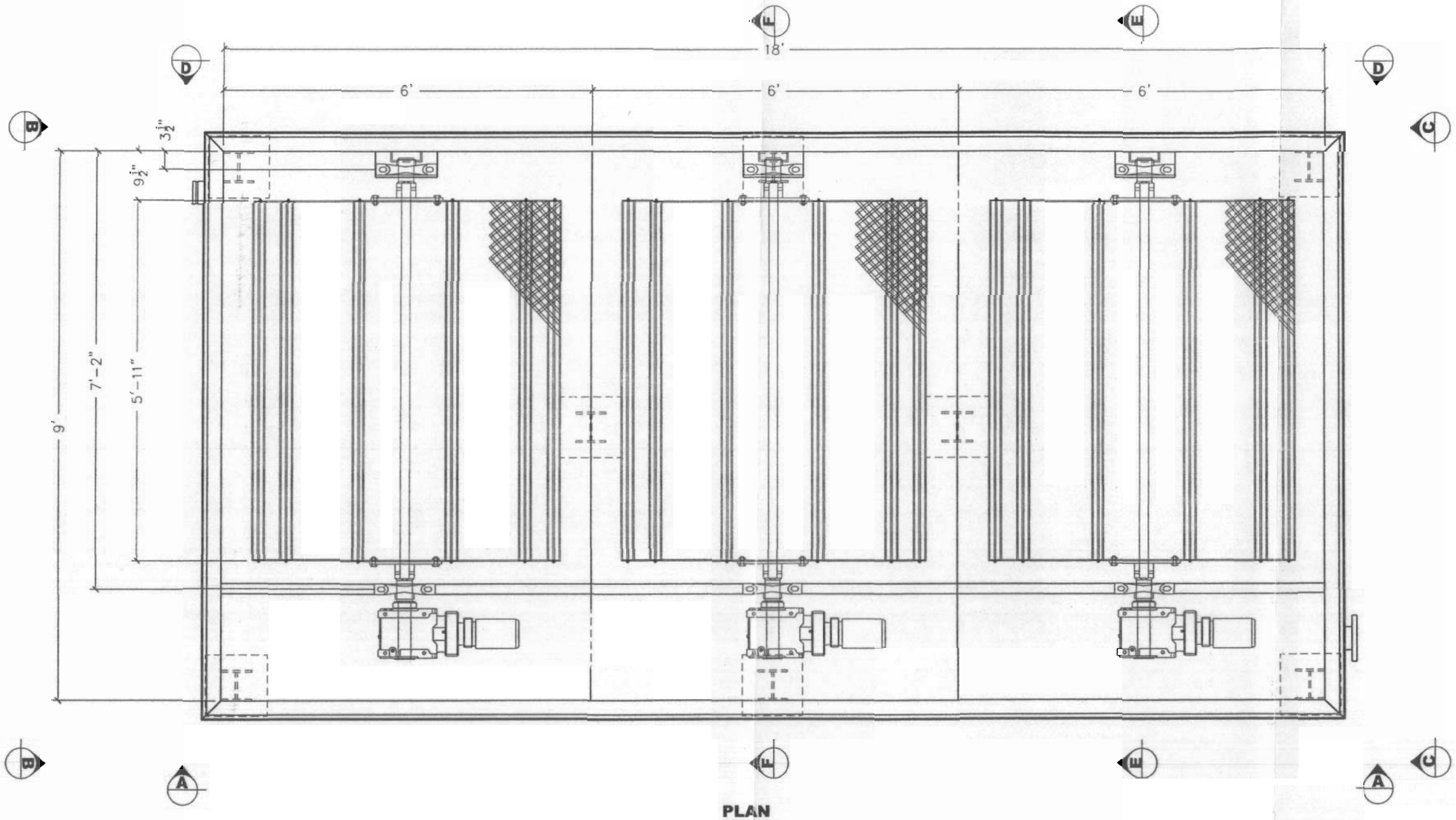
.1 The equipment specifications for the pre-purchased items are included at the end of this section, printed on blue paper for confirmation only. The following shop drawings are provided:

.1 Geoforms
.2 Final Clarifiers
.3 Equalization Tank
.4 Sludge Digestor Tanks

PART 2 - PRODUCTS

2.1 Equipment

.1 As per shop drawings and manufacturers specifications provided or as clarified by BCA - The clearwater Group



PLAN

REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

NOTE

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BCA The Clearwater Group™

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DESIGN	RJ
CHECKED	RJ
APPROVED	–
DATE	DEC28/01
SCALE	1/2"=1'

PANGNIRTUNG WWTP (S.O#006535)

TRAIN#1– GEO

FABRICATION DRAWING

SH. 1 OF 5

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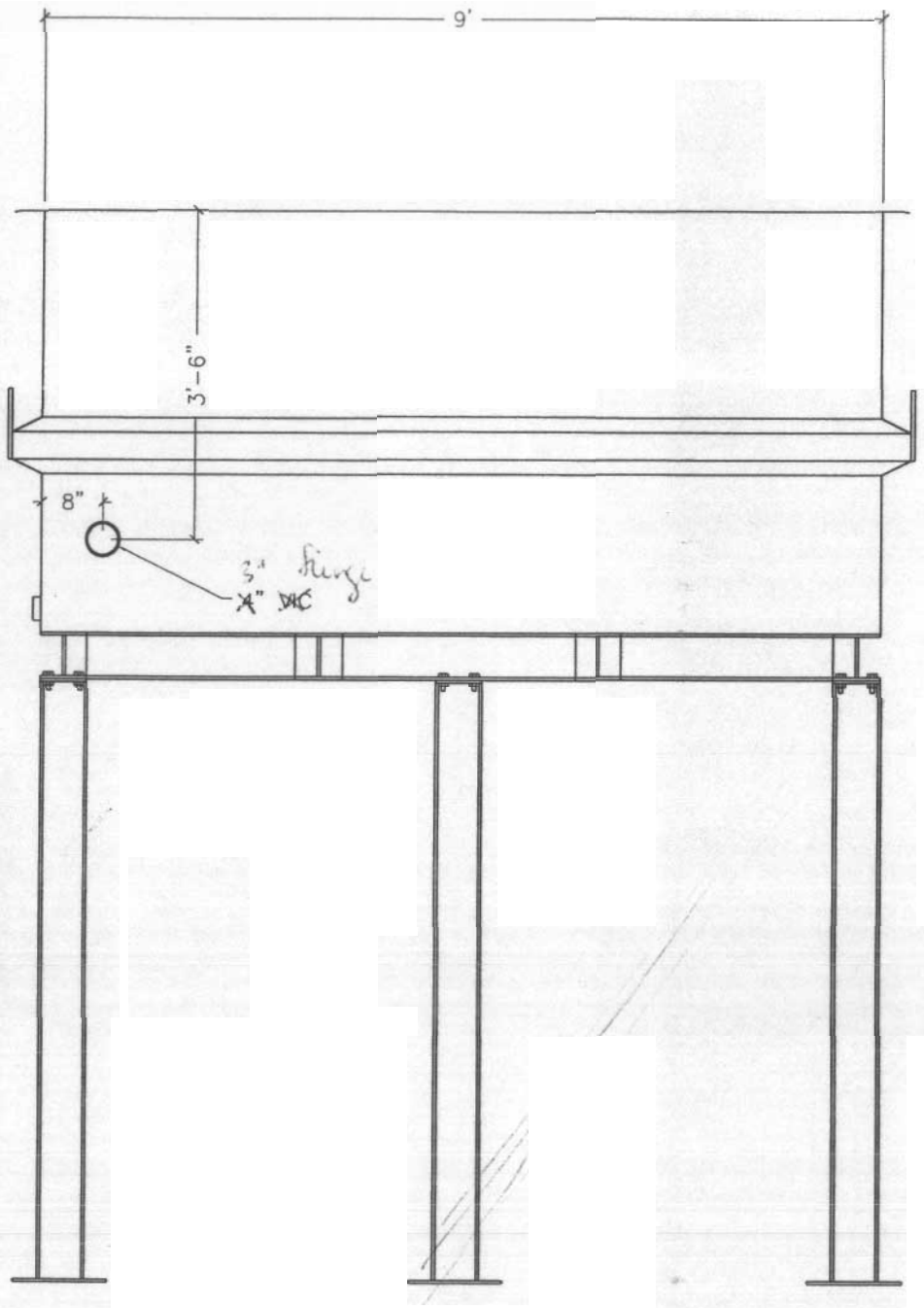

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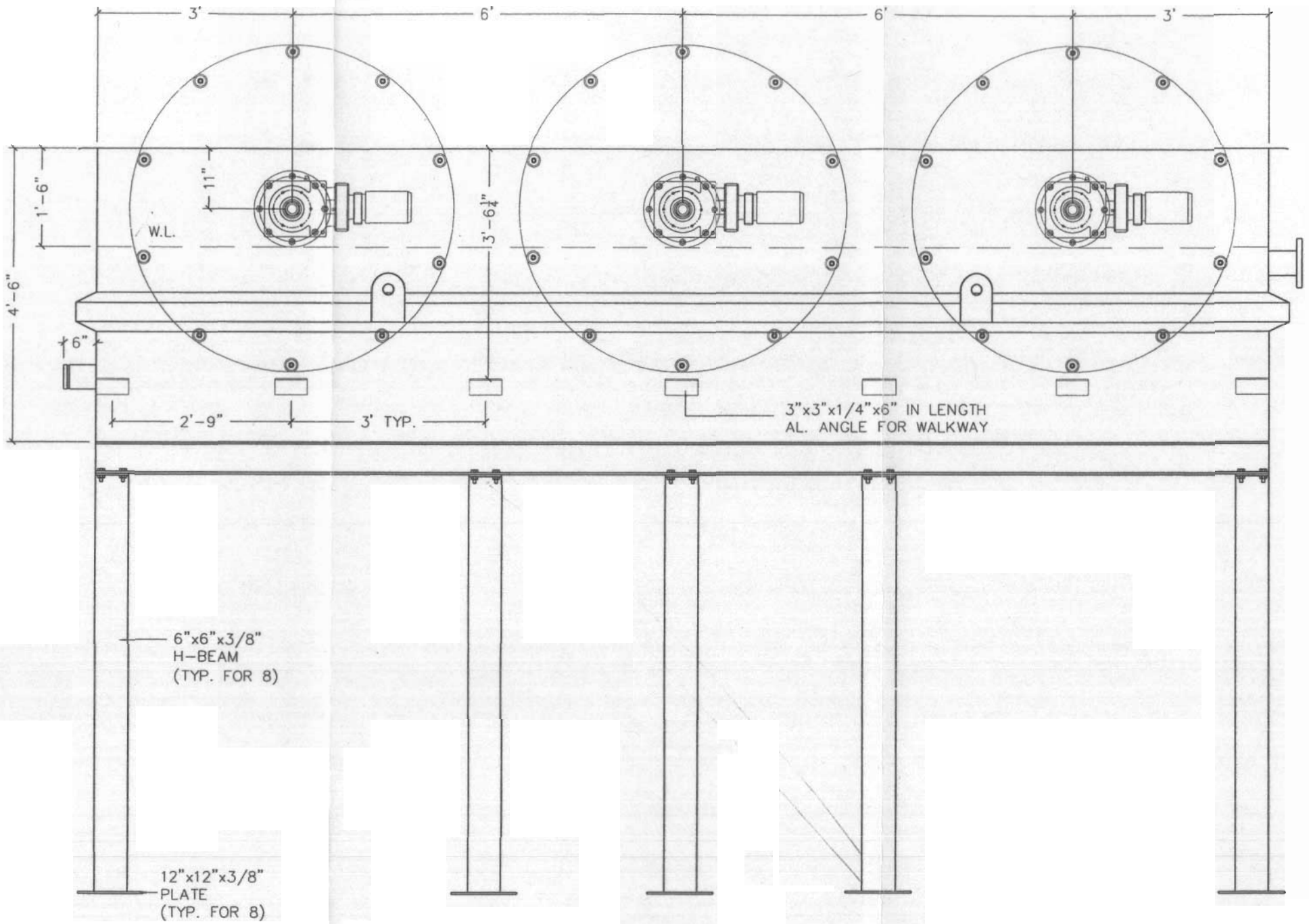

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REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

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BCA The Clearwater Group™

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CHECKED	RJ
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PANGNIRTUNG WWTP (S.O#006535)

TRAIN#1– GEO
FABRICATION DRAWING
SH. 2 OF 5

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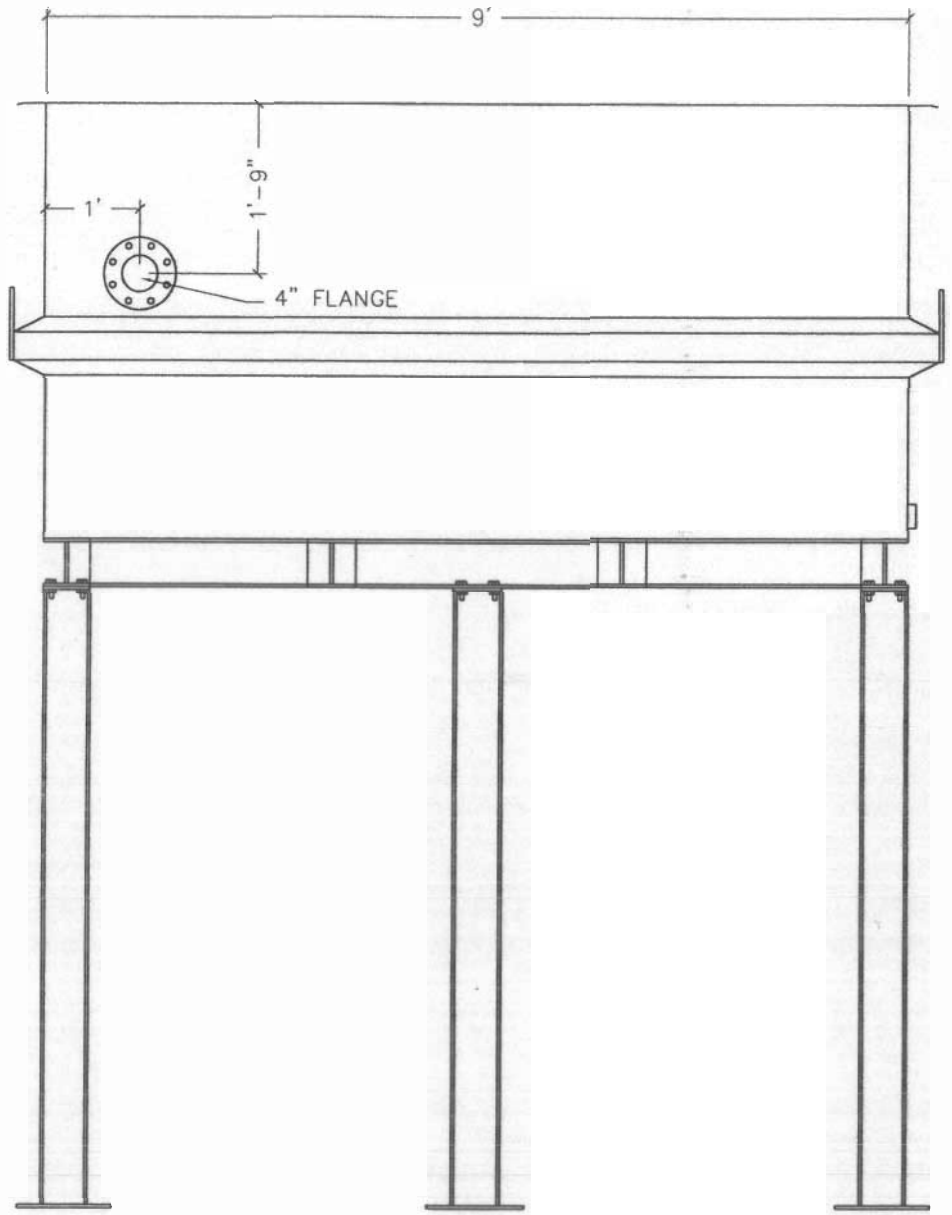
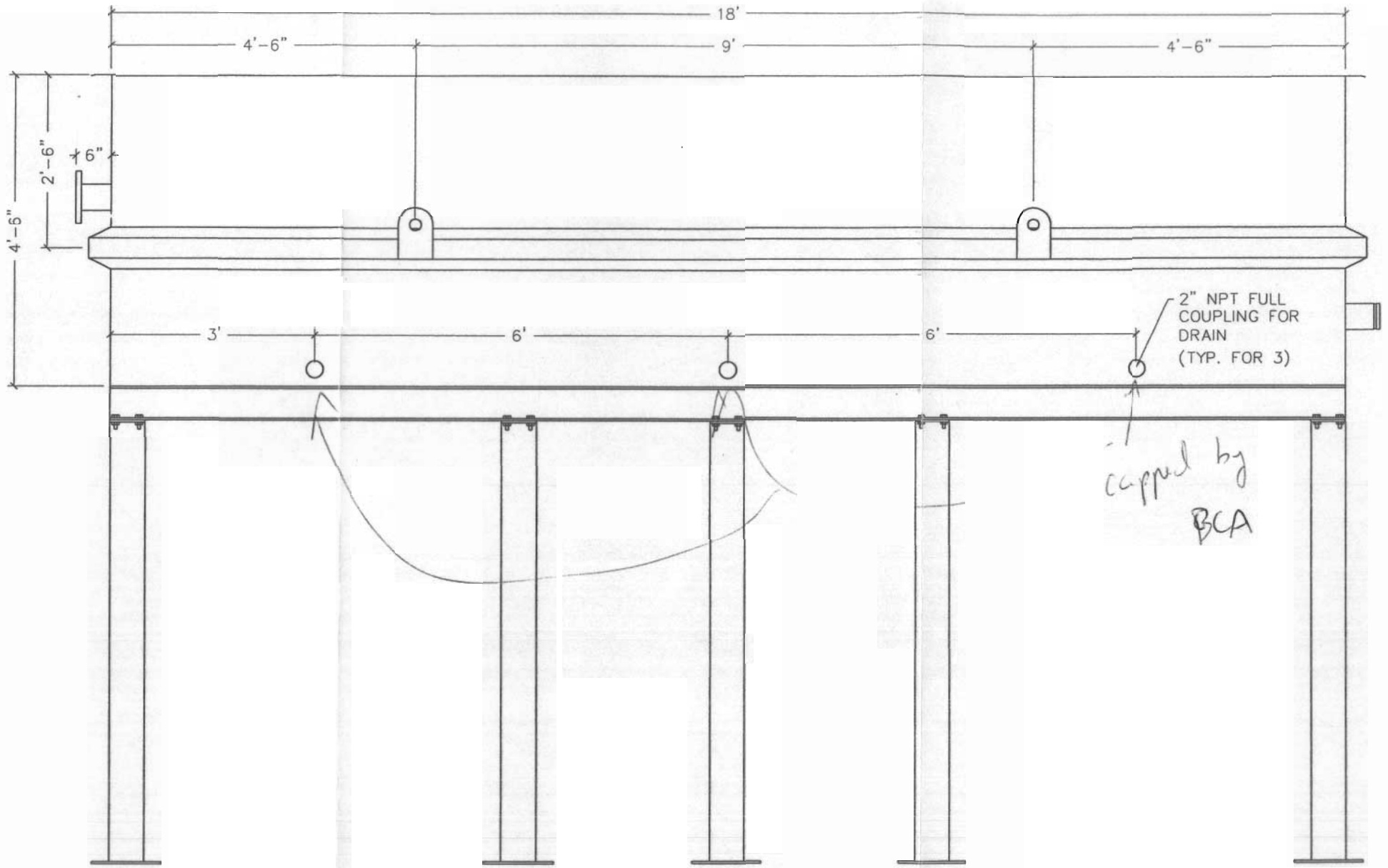


VIEW C-C



VIEW D-D

REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

NOTE

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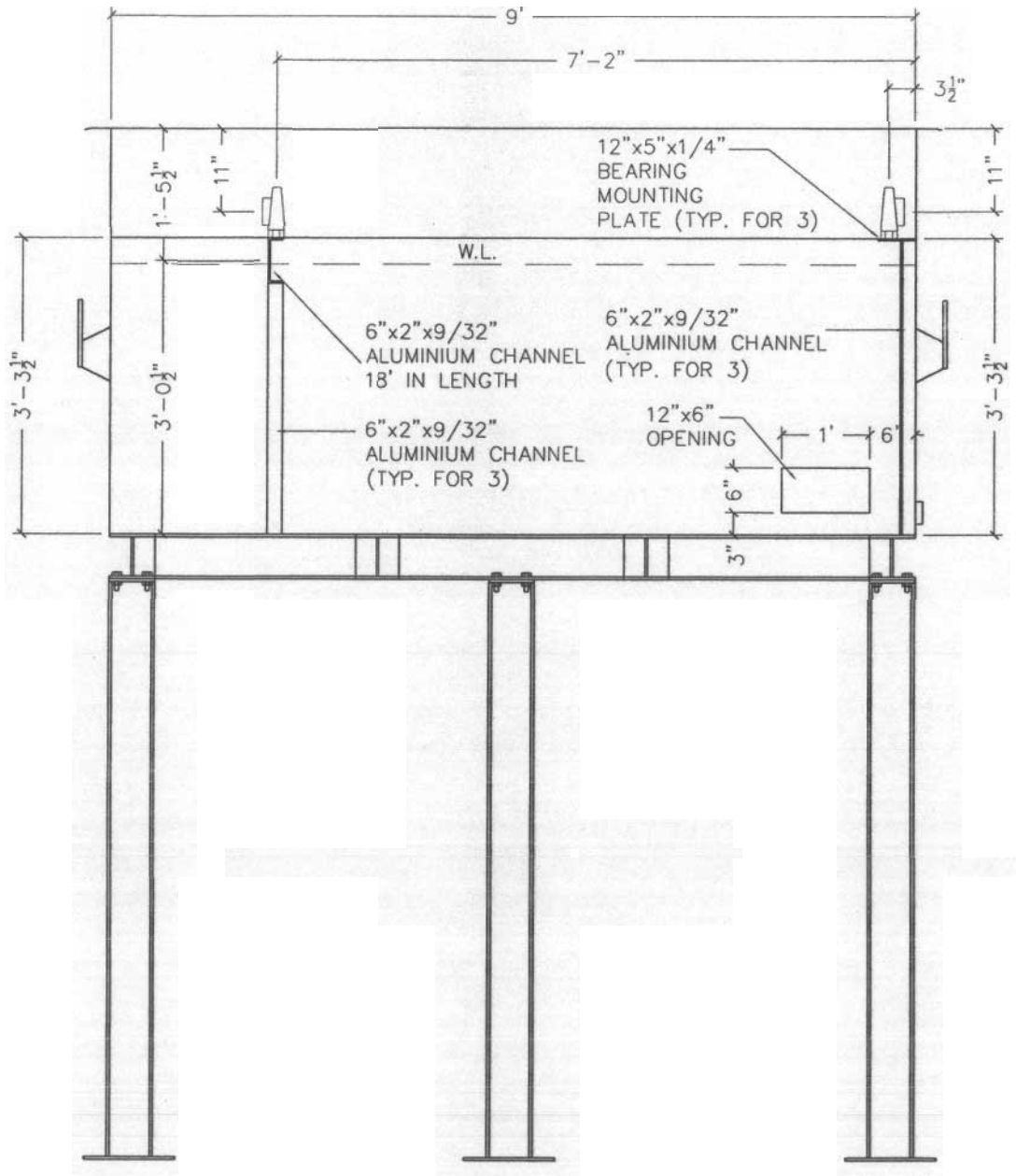
BCA The Clearwater Group™

DRAWN	LL
DESIGN	RJ
CHECKED	RJ
APPROVED	–
DATE	DEC28/01
SCALE	1/2"=1'

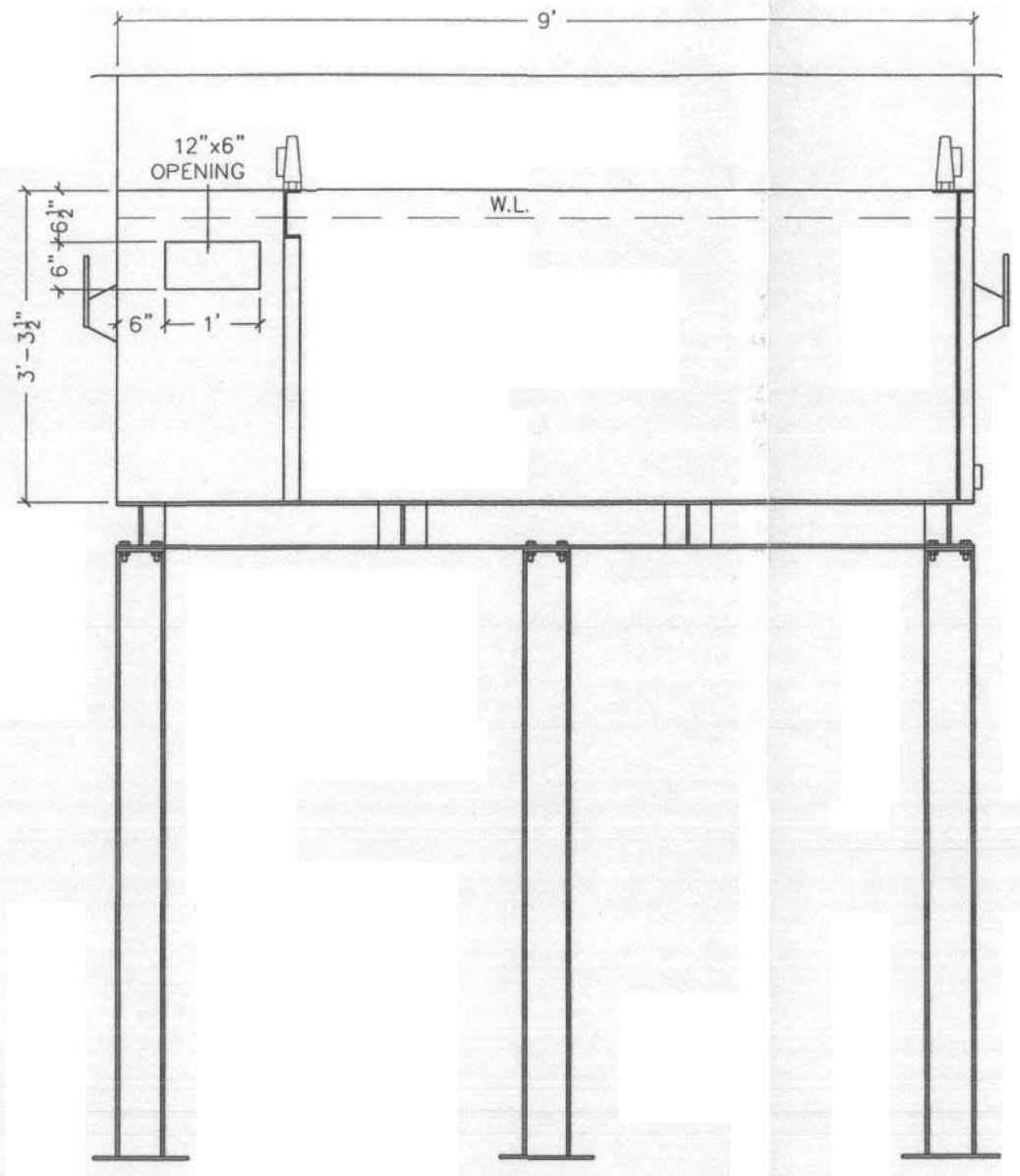
PANGNIRTUNG WWTP (S.O#006535)

TRAIN#1– GEO FABRICATION DRAWING SH. 3 OF 5

DRAWING NO. 017271–03 REV



VIEW E-E



VIEW F-F

REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

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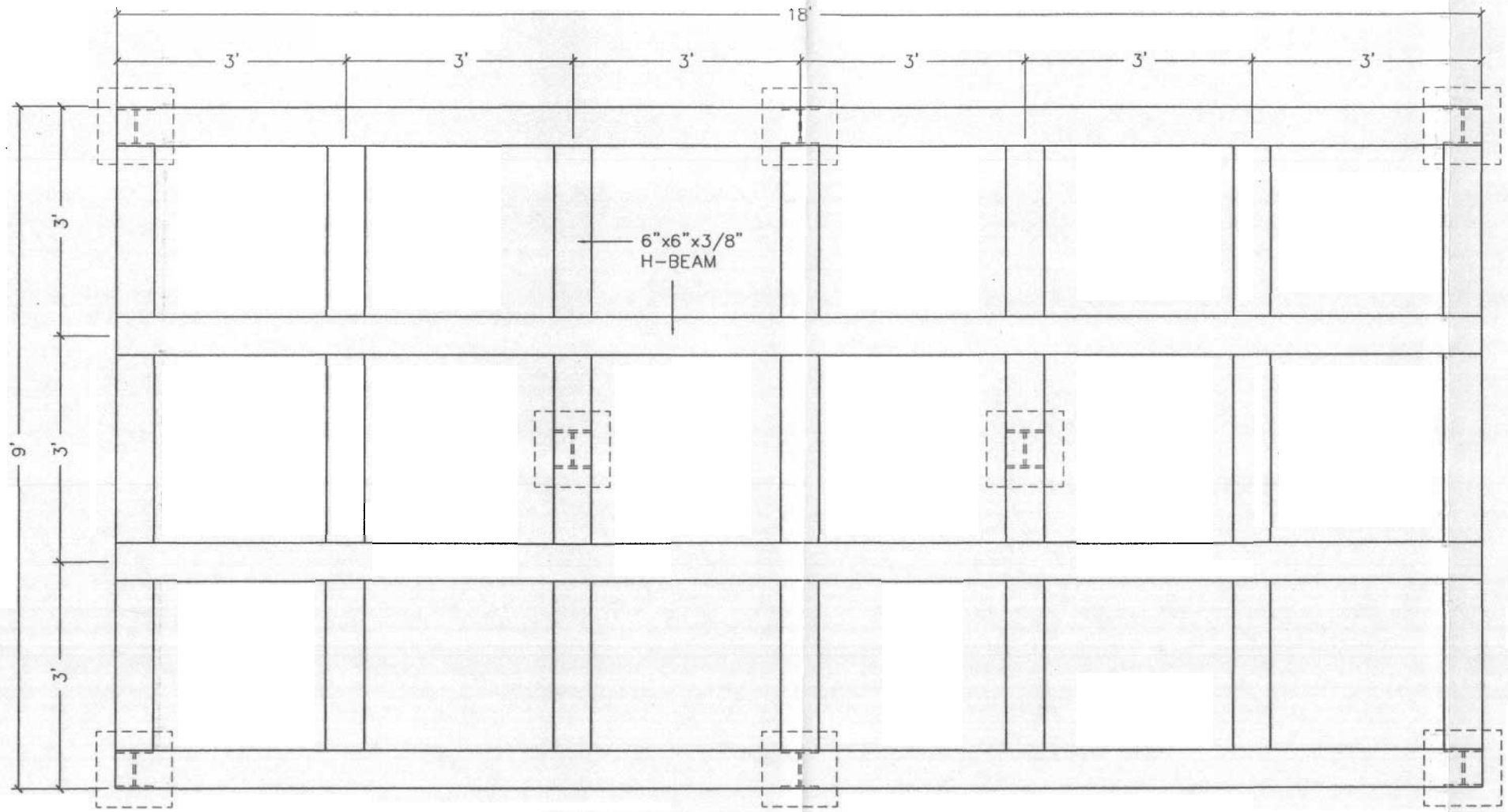
DRAWN	LL
DESIGN	RJ
CHECKED	RJ
APPROVED	–
DATE	DEC28/01
SCALE	1/2"=1'

PANGNIRTUNG WWTP (S.O#006535)

TRAIN#1– GEO
FABRICATION DRAWING
SH. 4 OF 5

DRAWING NO. 017271–03 REV



PLAN VIEW OF GEO SUPPORT BASE

REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

NOTE

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BCA

The Clearwater Group™

DRAWN	LL
DESIGN	RJ
CHECKED	RJ
APPROVED	–
DATE	DEC28/01
SCALE	1/2"=1'

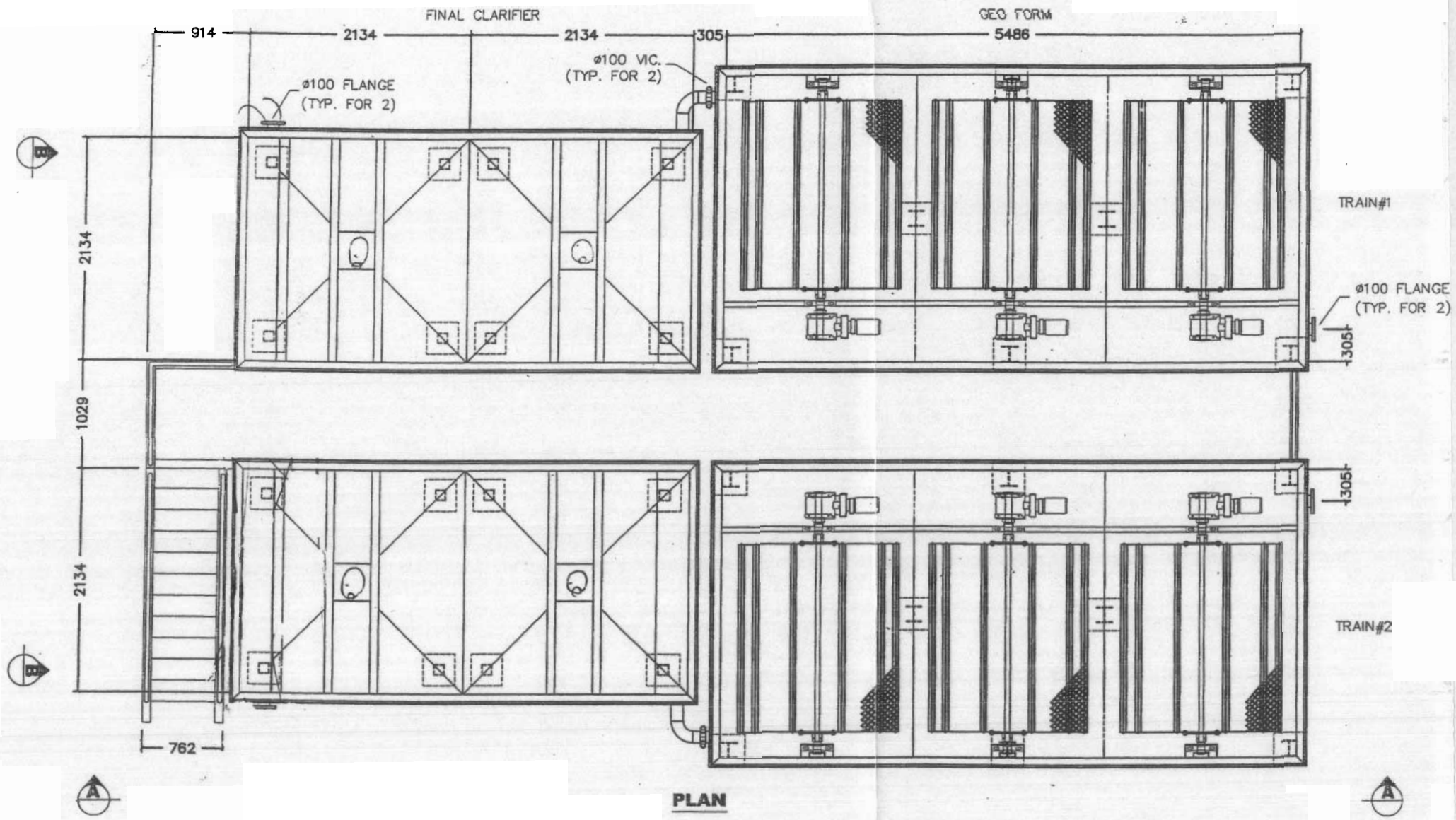
PANGNIRTUNG WWTP (S.O#006535)

TRAIN#1– GEO

FABRICATION DRAWING

SH. 5 OF 5

DRAWING NO. 017271–03 REV



PLAN

NOTES

1. TANKS TO BE CONSTRUCTED OF MARINE GRADE ALUMINIUM ALLOY 5086 H116. ALL WELDS CONTINUOUS BOTH SIDES WHERE POSSIBLE. STRUCTURE TO BE TESTED AFTER COMPLETION. EXTERIOR TO BE CLEANED WITH 'ACTION #105'.
2. DRAIN VALVES TO BE BRASS WITH STAINLESS STEEL NIPPLES WHERE CONNECTED TO ALUMINIUM.
3. INSTRUMENTATION PIPING TO BE SOLDERED COPPER OR PVC

REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

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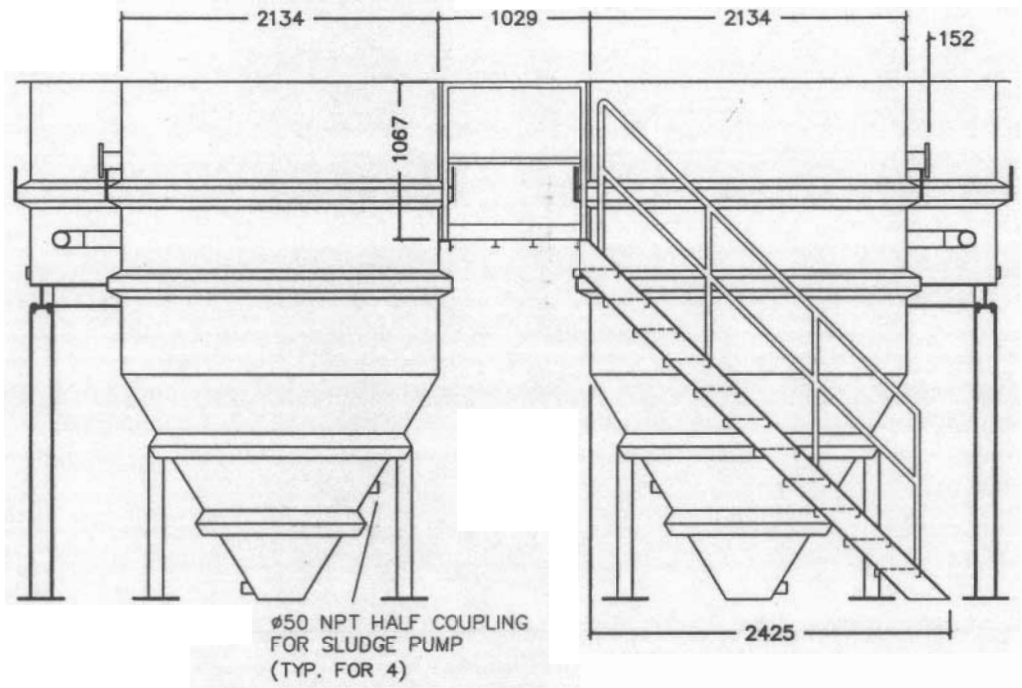
The Clearwater Group™

DRAWN	LL
DESIGN	RJ
CHECKED	RJ
APPROVED	–
DATE	DEC28/01
SCALE	1:50

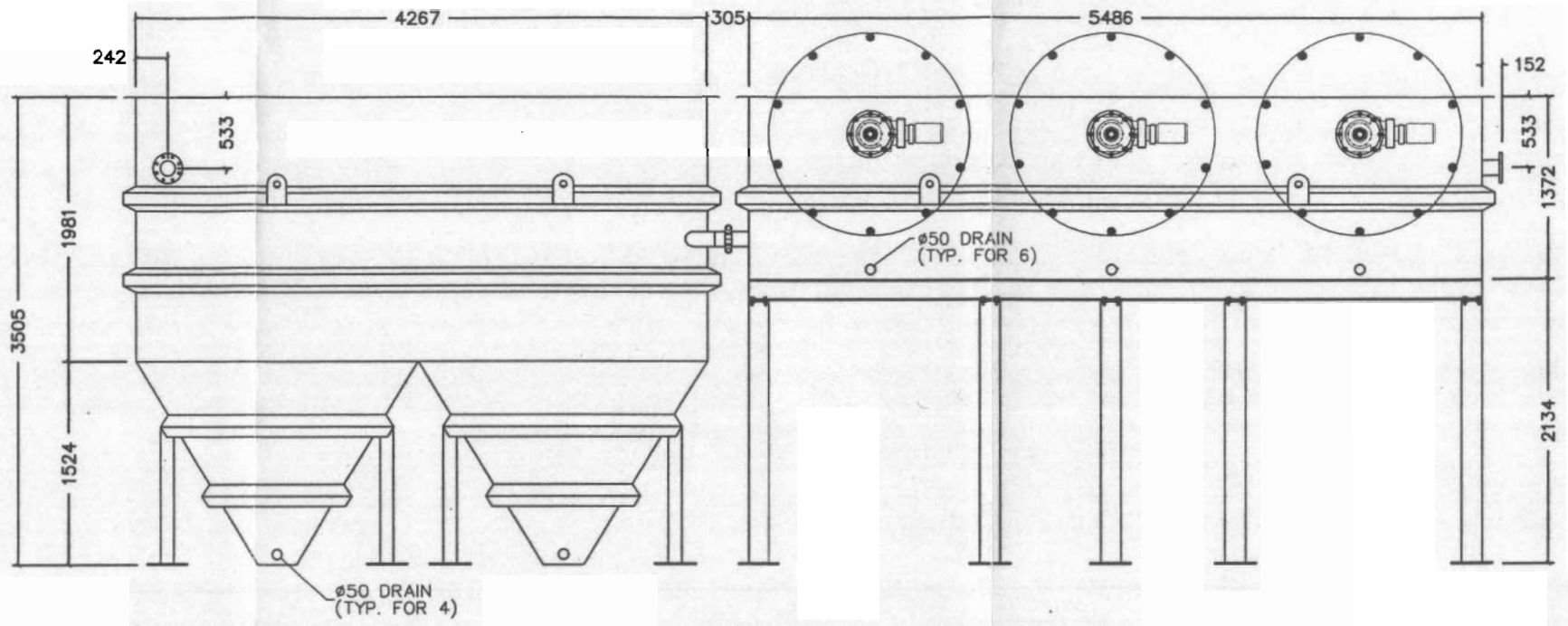
PANGNIRTUNG WWTP (S.O#006535)

FINAL CLARIFIER AND GEO FORM GENERAL PLAN LAYOUT SH. 1 OF 3

DRAWING NO. 017271–01 REV .



VIEW B-B



VIEW A-A

REV	DESCRIPTION	BY	CHK'D	APP'D	DATE

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The Clearwater Group™

DRAWN	LL
DESIGN	RJ
CHECKED	RJ
APPROVED	–
DATE	DEC28/01
SCALE	1:50

PANGNIRTUNG WWTP (S.O#006535)

FINAL CLARIFIER AND GEO FORM
GENERAL PLAN LAYOUT
SH. 2 OF 3

DRAWING NO. 017271–01 REV

ENGINEERED STORAGE PRODUCTS COMPANY

DEKALB, ILLINOIS 60115

GREATARIO *Industrial Storage Systems Ltd.*
SHOP DRAWING REVIEW
☑ Reviewed Date: 03/05/02
☐ Resubmit

PROJECT NAME: POND INLET (NUNAVIK)

PROJECT LOCATION: ONTARIO, CANADA

PROJECT NUMBER: 8011600

17 14 SF GLASSED

RELEASE No.: 1
RELEASE DATE: 1-28-2002

SLUDGE DIGESTER

THIS DOCUMENT CONSISTS OF 18 PAGES

SUBMITTED BY:	DATE:	DATE: 1/30/02 EXPIRES: 11/30/02
DATE:		STATE OF ILLINOIS RICHARD V. D. FIELD 5077 ALGONQUIN, IL LICENSED STRUCTURAL ENGINEER

TANK PROJECT DRAWING INDEX

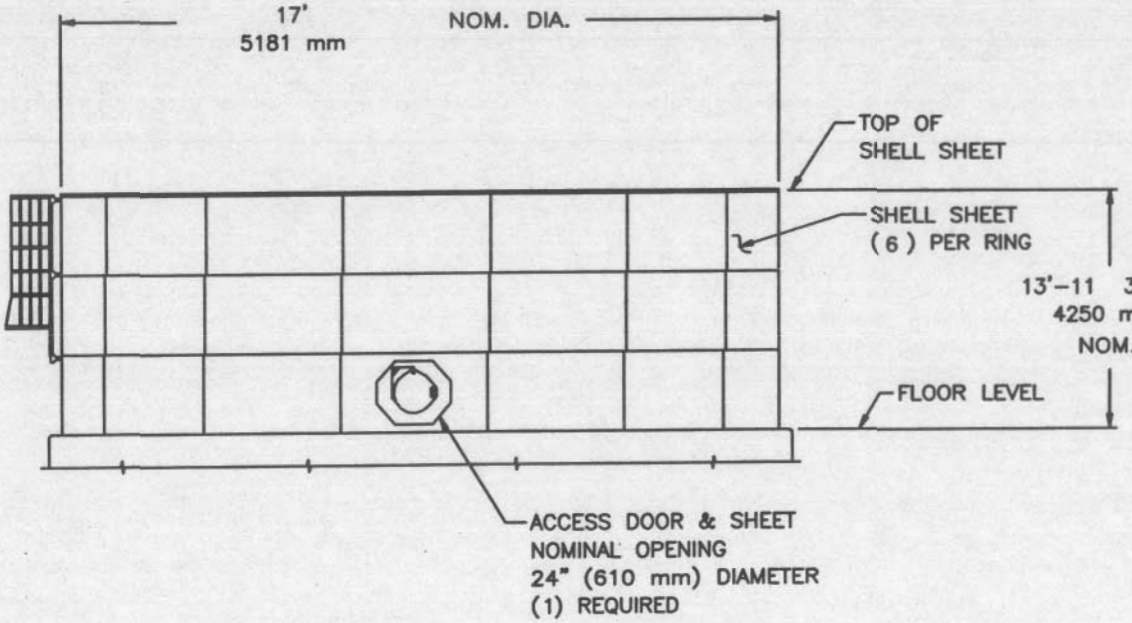
DOCUMENT NUMBER		DOCUMENT TITLE
8011600	-001	TANK DRAWING
8011600	-010	TANK CALCULATIONS
8011600	-011	TANK GENERAL NOTES
8011600	-012	TANK FASTENER SCHEDULE
8011600	-013	TANK SCHEMATIC
8011600	-014	TANK PARTS LIST

SF FOUNDATION PROJECT DRAWING INDEX

DOCUMENT NUMBER		DOCUMENT TITLE
8011600	-002	SF FOUNDATION DRAWING
8011600	-023	FOUNDATION PARTS LIST
8011600	-024	FOUNDATION FASTENER SCHEDULE
		MANUFACTURER'S EXTENDED WARRANTIES

NOTES:
1. THIS DRAWING IS NOT TO SCALE.
2. REFER TO TANK SCHEMATIC DOCUMENT –013 FOR NUMBER OF RINGS IN TANK AND RESPECTIVE SHEET THICKNESSES.
3. THIS TANK AND FLOOR ARE NOT DESIGNED FOR ANY EXTERNAL HYDROSTATIC LOADING.

TANK DESIGN FREEBOARD	6 in 152 mm



ELEVATION

REL	DESCRIPTION
1	REL PER MIP 8011600 01/28/02

ESPC PANEL INTERIOR COATING:
GLOBAL GLASS FUSED GLASS WITH EDGECOAT PROCESS
ESPC PANEL EXTERIOR COATING:
FUSED GLASS
SHELL COLOR: COBALT BLUE

ENGINEERED STORAGE PRODUCTS COMPANY
DEKALB, ILLINOIS 60115

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FILE: 8011600A

DRAWN BY TAK
DATE 01/28/02

1714 SFTT
SZ 1
POND INLET (NUNAVIK) ONTARIO, CANADA

DRWG NO. 8011600–001

REL.: 1
DATE: 1-28-2002
BY: JJS

SUMMARY OF INPUT DATA

STRUCTURE MODEL	17 14		
FOUNDATION TYPE	SF		
SPECIFIC GRAVITY	1.000		
H/V PRESSURE RATIO	1.000		
FREEBOARD	6.000 in	152.400	mm
ROOF TYPE	NONE		
ROOF WEIGHT	NA psf	NA	kg/m2
SC ROOF HEIGHT	NA in	NA	mm
DC ROOF PROJ AREA	NA sq ft	NA	sq m
DC ROOF CENTROID	NA in	NA	mm
TOTAL ROOF HEIGHT	NA in	NA	mm
SNOW (LIVE) LOAD	NA psf	NA	kPa
WIND DESIGN	NONE		
WIND SPEED	NA mph	NA	m/s
WIND STIFFENER ANALYSIS	NONE		
SEISMIC DESIGN	AWWA D103 97 (EFFECTIVE MASS)		
SEISMIC ZONE	1		
USE FACTOR, I	1.250		
SITE AMPLIFICATION FACTOR	1.200		
ALLOWABLES USED	AWWA D103 - 97		
FLOOR O.D.	16.875 ft	5143.500	mm

SUMMARY OF INTERNALLY ASSIGNED PARAMETERS

BOLT DIAMETER	.500 in	12.700	mm
HOLE DIAMETER	.5625 in	14.287	mm
TOP COURSE EDGE DIST	1.000 in	25.400	mm
STEEL FLOOR IN FNDN	.094 in	2.388	mm
DIST T/FTG TO B/FLR	.000 in	.000	mm
TOTAL FNDN THICKNESS	.094 in	2.388	mm
SHEET DENSITY	590.000 pcf	9451.	kg/m3
STEEL ELASTIC MODULUS	30000000. psi	206843.	MPa
STEEL FLOOR DENSITY	590. pcf	9451.	kg/m3
NET SHEET WIDTH	105.462 in	2678.735	mm
NET STANDARD SHEET HT.	54.990 in	1396.746	mm
STARTER PANEL HEIGHT	56.378 in	1432.001	mm
INVENTORY FILE USED:	8011600.DF		

17 14 AQUASTORE STRUCTURE DESIGN SUMMARY

COURSE	SHEET NUMBER	THICK in.	THICK mm	PLACE CODE	GEOM CODE	MAT CODE	LIMITING FACTOR(S)
1	1	.094	2.388	1	1101	1	0
2	2	.094	2.388	1	1101	1	0
FDN	3	.094	2.388	3	6100	1	0

ANCHORS REQUIRED:
NONE

STRUCTURE DIAMETER	=	16.78 ft	5116.01 mm
HEIGHT OF STRUCTURE TO EAVE	=	13.95 ft	4250.89 mm
SLOSHING WAVE HEIGHT	=	.29 ft	86.91 mm
VOLUME OF STRUCTURE TO EAVE	=	3086. cu ft	87. m3
VOLUME OF CONTENTS	=	2975. cu ft	84. m3
VOLUME OF CONTENTS	=	22257. gal	84251. L
VOLUME OF STEEL FLOOR FND.	=	2. cu ft	0. m3
WEIGHT OF EMPTY CYLINDER ABOVE FLOOR	=	3379. lb	1532. kg
WEIGHT OF ROOF	=	0. lb	0. kg
SNOW (LIVE) LOAD	=	0. lb	0. kg
WEIGHT OF CONTENTS	=	185659. lb	84214. kg
STEEL FLOOR WEIGHT	=	1034. lb	469. kg
TOTAL WEIGHT ON FOOTING	=	190071. lb	86215. kg
WIND SHEAR AT TOP OF FOOTING	=	0. lb	0. N
WIND MOMENT AT TOP OF FOOTING	=	0. ft-lb	0. kN-m
SEISMIC SHEAR AT TOP OF FOOTING	=	11650. lb	51822. N
SEISMIC MOMENT AT TOP OF FOOTING	=	69099. ft-lb	94. kN-m

HOOP STRESS ANALYSIS

COURSE	DEPTH FT	PRESS PSI	NET TENS	ALLOW TENS	HOLE BEAR	ALLOW BEAR	BOLT SHEAR	ALLOW SHEAR
			STRESS - PSI					
1	4.2	1.8	2635.	14566.	8181.	40500.	1958.	18163.
2	8.7	3.8	5533.	14566.	17180.	40500.	4112.	18163.
FND	13.4	5.8	8505.	14566.	26407.	40500.	6321.	18163.

AXIAL STRESS ANALYSIS

COURSE	AXIAL COMP	ALLOW COMP	HOLE BEAR	ALLOW BEAR	BOLT SHEAR	ALLOW SHEAR
		STRESS - PSI				
1	19.	1809.	189.	40500.	45.	18163.
2	38.	1809.	377.	40500.	90.	18163.
FND	57.	1809.	285.	40500.	68.	18163.

SEISMIC STRESS ANALYSIS

COURSE	AXIAL COMP	SEIS BEND	TOTAL COMP	ALLOW COMP	HOLE BEAR	ALLOW BEAR	BOLT SHEAR	ALLOW SHEAR
			STRESS - PSI					
1	19.	19.	38.	3706.	384.	54000.	92.	24217.
2	38.	106.	144.	4443.	1445.	54000.	346.	24217.
FND	57.	276.	333.	4910.	1673.	54000.	400.	24217.

SEISMIC STRESS ANALYSIS CONTINUED

COURSE	STRESS - PSI HDYN HOOP	TOTAL HOOP	ALLOW TENS
1	196.	2831.	19421.
2	273.	5806.	19421.
FND	293.	8798.	19421.

DOCUMENT NUMBER: 8011600 -011 REL.: 1 TITLE: TANK GENERAL NOTES

TANK DESIGN SPECIFICATIONS

This tank is designed in accordance with AWWA Standard D103-97.

COATINGS SPECIFICATIONS

Coatings used on components of this tank are in compliance with the appropriate sections of AWWA Standard D103.

STRUCTURE BOLT SPECIFICATIONS

Structure bolts are as defined in AWWA Standard D103 Sect. 2.2.1. All bolts are 1/2"-13 UNC-2A thread, carbon steel, zinc plated, and have the following minimum tensile strengths.

A. 1"	Long	74 KSI	510 MPa
B. 1-1/4"	Long and longer	150 KSI	1034 MPa

APPURTENANCE AND PIPING ORIENTATION

Orientation of all appurtenances and piping connections shall be established in the field.

THROUGH-THE-SHEET PENETRATIONS

All openings through the tank side wall greater than 4 inches (102mm) in diameter shall be reinforced in accordance with AWWA D103, Section 3.11.

All openings through sheets having less than 24 inches (610 mm) between horizontal bolt lines, or having less than 24 inches (610 mm) of available sheet space from the floor surface up to the first horizontal bolt line shall not exceed a diameter of 4 inches (102 mm). These openings of 4 inches (102 mm) and less shall be reinforced in accordance with AWWA D103, Section 3.11.

LADDER SPECIFICATIONS

The ladder system is manufactured in compliance with AWWA Standard D103 Section 5.4. In addition, the tank ladder side rails are fabricated from 6061-T6 aluminum while the ladder rungs are fabricated from 6061-T4 aluminum.

CATHODIC PROTECTION SPECIFICATIONS

This tank is equipped with a cathodic protection system. This system is designed to protect the items described below.

Entire submerged portion of tank sidewall and floor area including appurtenances supplied by the tank manufacturer.

Submerged uncoated metal objects not supplied by the tank manufacturer totaling: 0.0 sq. ft.

Submerged coated metal objects not supplied by the tank manufacturer totaling: 0.0 sq. ft.

This system is suitable for use in liquid having a resistivity of 500 ohm-centimeters. Field verification of resistivity limits is required after the tank is placed into service. The performance of the cathodic protection system may be adversely affected if the system is operated outside the resisitivity limits above.

The presence of submerged uncoated metallic items, for which cathodic protection has not been provided by the tank supplier, may also adversely affect the performance of the cathodic protection system. Electrical isolation and/or the determination of the cathodic protection requirements for such submerged items shall be the responsibility of the owner or the owner's designated agent. Tank warranty issues may also be affected.

For further information, refer to the instructions provided with the cathodic protection system.

DOCUMENT NUMBER: 8011600 -012 REL.: 1 TITLE: TANK FASTENER SCHEDULE

STRUCTURE BOLT QUANTITIES AT (H)ORIZONTAL & (V)ERTICAL SEAMS

	THRU THE SHEET FASTENERS						TRUSS FASTENERS		
BOLT LENGTHS: (mm) :	1" 25.40	1 1/4" 31.75	1 1/2" 38.10	1 3/4" 44.45	2" 50.80	2 1/4" 57.15	1 1/4" 31.75 C.S.	2 1/4" 57.15 C.S.	3" 76.20 C.S.
SEAM Wide H 1	0	128	28	0	0	0	0	0	0
SEAM V 1	150	0	0	0	0	0	0	0	0
SEAM Wide H 2	118	14	0	0	0	0	0	0	0
SEAM V 2	150	0	0	0	0	0	0	0	0
SEAM Fnd. H 3	120	12	0	0	0	0	0	0	0
ACCESS DOOR	0	0	30	0	0	0	0	0	0
REINFORCING PLT.	74	0	0	0	0	0	0	0	0
TOTALS:	612	154	58	0	0	0	0	0	0

DOCUMENT NUMBER: 8011600 -013 REL.: 1 TITLE: TANK SCHEMATIC

NOTE: ALL BRACKETS LOCATED AT TOP OF SPECIFIED RING

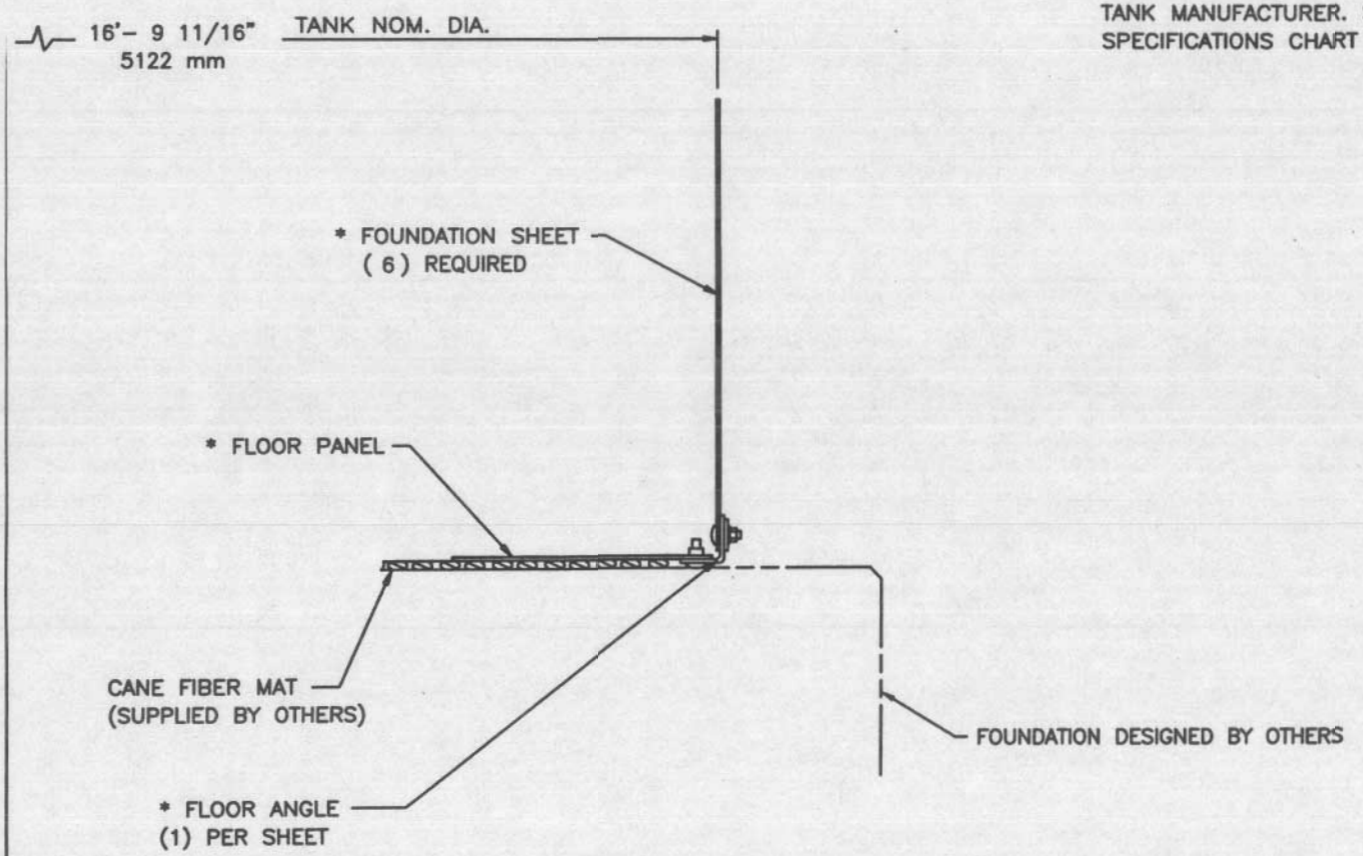
RING #	SHEET THICK.	BRKT. TYPE	QTY.
	Inside angle at top ring. Use tapered spacer at top horizontal seam		
RING #: 1....	.094.....	Y-BRKT.....	2
RING #: 2....	.094.....	Y-BRKT.....	2
FND. :	.094.....	Y-BRKT.....	2

NOTE: Tank color - Cobalt BLUE

ITEM	QTY.	PART NO.	DESCRIPTION
-	1	8011600-001	TANK ASSEMBLY
1	1	8011600-002	FOUNDATION ASSEMBLY
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17	1	263598-002	LADDER KIT (W/CAGE)
18			
19			
20			
21			
22			
23			
24			
25			
26			
27	6	258898-017	STIFFENER ANGLE
28	6	258899-002	SPLICE ANGLE
29	6	084373-000	TAPERED SPACER
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45	612	262000-001	STRUCTURE BOLT, 1", BLACK
46	154	262000-002	STRUCTURE BOLT, 1 1/4", BLACK
47	58	262000-003	STRUCTURE BOLT, 1 1/2", BLACK
48			
49			
50			
51			

ITEM	QTY.	PART NO.	DESCRIPTION
52			
53			
54			
55	824	252275-000	WASHER, 1/2"
56	824	262416-001	HEX. NUT, 1/2" HDZ
57			
58			
59	8	265777-203	SEALER 98, 20 oz POUCHES
60	2	264913-000	BUSS BAR
61	1	266681-000	ANODE INSPECTION/TESTING
62	1	266680-300	CATHODIC PROT. SYSTEM - ZINC
63			
64			
65	3	255495-000	INSTRUCTION DECAL
66	3	262778-000	DANGER DECAL
67			
68	1	266182-000	NAMEPLATE
69	1	262355-000	OPERATORS MANUAL
70	3	262166-000	IMPORTANT DECAL
71	3	260581-000	TANK MOD. WARNING DECAL
72	1	265307-000	INSPECTION & MAINT. REVIEW
73			
74	3	260910-000	"Y" BRACKET ASSY. SET (SHORT)
75			
76			
77			
78			
79			
80			
81			
82			
83			
84			
85	12	256047K0100	SHELL SHEET .094" HRS
86			
87			
88			
89			
90			
91			
92			
93			
94			
95			
96			
97			
98			
99			
100			
101			
102			
103			
104			
105			
106			

NOTES:
1. THIS DRAWING IS NOT TO SCALE.
2. ITEMS INDICATED * TO BE SUPPLIED BY THE TANK MANUFACTURER. SEE * ESPC PARTS SPECIFICATIONS CHART ON THIS DRAWING.



SECTION THROUGH FOUNDATION

REL	DESCRIPTION
1	REL PER MIP 8011600 01/28/02

* ESPC PARTS SPECIFICATIONS		
FLOOR ANGLES	IN.	3 X 3 X 1/4
	mm	76 X 76 X 6

ENGINEERED STORAGE PRODUCTS COMPANY
DEKALB, ILLINOIS 60115

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FILE: 8011600B

DRAWN BY TAK
DATE 01/28/02

17' SF FND
SZ 1
POND INLET
(NUNAVIK)
ONTARIO, CANADA

DRWG NO. 8011600-002

DOCUMENT NUMBER: 8011600 -023 REL.: 1 TITLE: FOUNDATION PARTS LIST

NOTE: Tank color - Cobalt BLUE

ITEM	QTY.	PART NO.		DESCRIPTION
-	1	8011600	002	S.F. FOUNDATION ASSY.
1	5	266688K0100		.0940" FND. SHT. HRS
2	1	263745K0100		17 FT. DIA. FLOOR ASSEMBLY
3				
4	1	266216K0137		ACCESS DOOR SHEET
5	1	259813-017		24" ACCESS DOOR ASSEMBLY
6	1	266214-1300		REINFORCING PLATE
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18	23	265777-	203	SEALER 98, 20 oz (BLACK)
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33	45	263156-001		ENCAPSULATED NUT, PLASTIC
34				
35				
36				
37	150	262000-001		STRUCTURE BOLT 1", BLACK
38	255	262000-002		STRUCTURE BOLT 1 1/4", BLACK
39	36	262000-003		STRUCTURE BOLT 1 1/2", BLACK
40				
41	441	262416-001		HEX NUT, 1/2" HDZ
42	456	252275		WASHER, 1/2"

ITEM	QTY.	PART NO.	DESCRIPTION
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57	1	266346K0100	CENTER COVER PLATE
58			
59			
60			
61			
62			
63			
64			
65			
66			
67			
68			
69			
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
80			

FOUNDATION BOLTS FASTENER SCHEDULE

(in) (mm)	1 25.41	1 1/4 31.75	1 1/2 38.10	1 3/4 44.45
ANCH. CHAIR	0	0	0	0
VERTICAL	150	0	0	0
HORIZONTAL	0	210	36	0

Engineered Storage Products Company

Manufacturer's
Extended Warranty

One-Year Warranty

Engineered Storage Products Company ("ESPC") warrants that an Aquastore® brand liquid storage tank will be free from defects in workmanship and materials, under normal and proper use, maintenance and operation, during the period expiring on the earlier of (i) one year after liquid is first introduced into the tank or (ii) 14 months after shipment from the factory.

10-Year Extended Performance Warranty

ESPC further warrants that the glass coated product zone surfaces (that portion of the tank interior below the normal high elevation of the contained liquid) of an Aquastore brand liquid storage tank will not corrode, under normal and proper use, maintenance and operation, during the period expiring on the earlier of (i) 120 months after liquid is first introduced into the tank or (ii) 122 months after shipment from the factory, if the tank is purchased with an Aquastore brand cathodic protection system.

Limitations and Conditions

ESPC's Limited Warranties are subject to the following limitations and conditions:

a. ESPC's Limited Warranties shall remain in effect only as long as the tank is used for the storage of municipal potable water or municipal sewage waste water. ESPC's Limited Warranties shall become void and terminate should the tank be used for storage of any other liquid unless specified in writing by Owner prior to ESPC's acceptance of the order for the tank.

b. ESPC's Limited Warranties do not cover corrosion due to damage caused by shipping, handling or tank erection, or damage caused by operating or maintenance activities. ESPC makes no warranty about and shall not be responsible for any defects in erection or installation of a tank.

c. ESPC's Limited Warranties shall become void and terminate if any alterations are made to the tank without the prior written approval of ESPC.

d. ESPC's Limited Warranties shall become void and terminate if the tank is not used, operated and maintained in accordance with requirements stated in the ESPC Operating Manual(s) supplied with the tank, or if the tank is damaged or subject to any abuse, misuse or vandalism.

Limitation of Remedies

In the event of any failure of any Aquastore brand liquid storage tank to perform as warranted in the One-Year Warranty, the sole and exclusive obligation of ESPC shall be, at its sole option, either to repair the tank or repair or replace any part of the tank which is defective. In the event of any failure of any Aquastore brand liquid storage tank to perform as warranted in the 120-Month Warranty, the sole and exclusive obligation of ESPC shall be, at its sole option, either to repair the tank or repair or replace any tank sheet(s) which has (have) corroded.

IN NO EVENT SHALL ESPC BE LIABLE (WHETHER FOR BREACH OF WARRANTY OR CONTRACT, FOR STRICT LIABILITY OR NEGLIGENCE, OR OTHERWISE) FOR ANY SPECIAL, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF CONTENTS OR LOSS OF PROFITS, OR FOR THE CONDITION OR QUALITY OF LIQUID STORED IN THE TANK, OR FOR ANY INABILITY OF OWNER TO PROVIDE WATER OR SERVICE TO ANY CUSTOMER OF OWNER.

Any action against ESPC for breach of warranty or contract, or for strict liability, negligence or otherwise relating to a tank, must be commenced within one year after such cause of action accrues.

Any Warranty claim shall be made to ESPC in writing. Once a claim has been made, ESPC shall have the right to perform on-site inspections of the tank. If ESPC is required to do repair work (which, for purposes of this paragraph, shall include repairing or replacing defective parts or corroded sheets) on the tank, ESPC shall be granted permission to perform such work with its own service personnel or personnel of others, and under nonunion conditions unless ESPC otherwise agrees. Any repairs made to a tank before ESPC is notified of a claim shall be at the Owner's expense. Preparation for inspection or repair of a tank (such as removing the contents and obstructive equipment in the tank) shall be the sole responsibility and expense of Owner. Preparation of the tank for use after repair (such as sanitation of the tank and reinstallation of equipment) shall also be the sole responsibility and expense of Owner.

Disclaimers

EXCEPT FOR THE LIMITED WARRANTIES SET FORTH ABOVE, THERE ARE NO UNDERSTANDINGS, AGREEMENTS, REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, RESPECTING THE AQUASTORE BRAND LIQUID STORAGE TANK. ESPC EXPRESSLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

ESPC's Authorized Dealers are independent contractors and are not agents or employees of ESPC. No statement by any ESPC Authorized Dealer or any ESPC employee shall constitute an understanding, agreement, representation or warranty by ESPC. ESPC makes no warranty with respect to goods manufactured by others, even if sold by an ESPC Authorized Dealer.

These Limited Warranties and related limitations and disclaimers cannot be modified or amended by an ESPC Authorized Dealer, and can be modified or amended only by a written document signed by an authorized ESPC employee.

ENGINEERED STORAGE PRODUCTS COMPANY

345 Harvestore Drive
DeKalb, Illinois 60115-9607 U.S.A.
815-756-1551 Phone, 815-756-7821 Fax

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ESPC P/N 265015-000 Rel. 4 ECN 01097

ENGINEERED STORAGE PRODUCTS COMPANY

DEKALB, ILLINOIS 60115

GREATARIO *Industrial Storage Systems Ltd.*

SHOP DRAWING REVIEW

☒ ~~Reviewed~~ Date: 03/05/02.

☐ Resubmit

PROJECT NAME: POND INLET (NUNAVIK)

PROJECT LOCATION: ONTARIO, CANADA

PROJECT NUMBER: 8020149

25 14 SF GLASSED

RELEASE No.: 1
RELEASE DATE: 1-28-2002

SEWAGE EQ TANK

BCA - The Clearwater Group
#100 - 20329 Logan Avenue
Langley, BC V3A 4L8

THIS DOCUMENT CONSISTS OF 18 PAGES

SUBMITTED BY:	DATE:	DATE: 1/30/02 EXPIRES: 11/30/02
DATE:		STATE OF ILLINOIS RICHARD V. D. FIELD 5077 ALGONQUIN, IL LICENSED STRUCTURAL ENGINEER

TANK PROJECT DRAWING INDEX

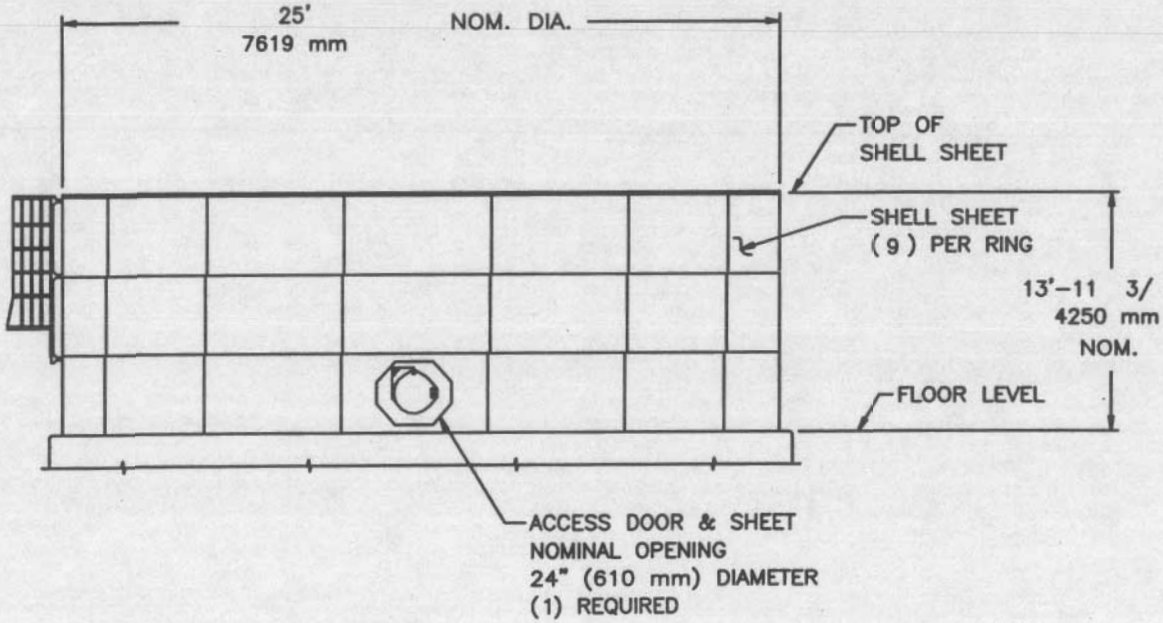
DOCUMENT NUMBER		DOCUMENT TITLE
8020149	-001	TANK DRAWING
8020149	-010	TANK CALCULATIONS
8020149	-011	TANK GENERAL NOTES
8020149	-012	TANK FASTENER SCHEDULE
8020149	-013	TANK SCHEMATIC
8020149	-014	TANK PARTS LIST

SF FOUNDATION PROJECT DRAWING INDEX

DOCUMENT NUMBER		DOCUMENT TITLE
8020149	-002	SF FOUNDATION DRAWING
8020149	-023	FOUNDATION PARTS LIST
8020149	-024	FOUNDATION FASTENER SCHEDULE
		MANUFACTURER'S EXTENDED WARRANTIES

NOTES:
1. THIS DRAWING IS NOT TO SCALE.
2. REFER TO TANK SCHEMATIC DOCUMENT –013 FOR NUMBER OF RINGS IN TANK AND RESPECTIVE SHEET THICKNESSES.
3. THIS TANK AND FLOOR ARE NOT DESIGNED FOR ANY EXTERNAL HYDROSTATIC LOADING.

TANK DESIGN FREEBOARD	6 in 152 mm



ELEVATION

REL	DESCRIPTION
1	REL PER MIP 8020149 01/28/02

ESPC PANEL INTERIOR COATING:
GLOBAL GLASS FUSED GLASS WITH EDGECOAT PROCESS
ESPC PANEL EXTERIOR COATING:
FUSED GLASS
SHELL COLOR: COBALT BLUE

ENGINEERED STORAGE PRODUCTS COMPANY
DEKALB, ILLINOIS 60115

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FILE: 8020149A

DRAWN BY TAK
DATE 01/28/02

2514 SFTT
SZ 1
POND INLET (NUNAVIK) ONTARIO, CANADA

DRWG NO. 8020149–001

REL.: 1
DATE: 1-28-2002
BY: JJS

SUMMARY OF INPUT DATA

STRUCTURE MODEL ----------	25 14		
FOUNDATION TYPE ----------	SF		
SPECIFIC GRAVITY ---------	1.000		
H/V PRESSURE RATIO -------	1.000		
FREEBOARD ----------	6.000 in	152.400	mm
ROOF TYPE ----------	NONE		
ROOF WEIGHT ----------	NA psf	NA	kg/m2
SC ROOF HEIGHT ----------	NA in	NA	mm
DC ROOF PROJ AREA ---------	NA sq ft	NA	sq m
DC ROOF CENTROID ---------	NA in	NA	mm
TOTAL ROOF HEIGHT ---------	NA in	NA	mm
SNOW (LIVE) LOAD ---------	NA psf	NA	kPa
WIND DESIGN ----------	NONE		
WIND SPEED ----------	NA mph	NA	m/s
WIND STIFFENER ANALYSIS ---	NONE		
SEISMIC DESIGN ----------	AWWA D103 97 (EFFECTIVE MASS)		
SEISMIC ZONE ----------	1		
USE FACTOR, I ----------	1.250		
SITE AMPLIFICATION FACTOR ---	1.200		
ALLOWABLES USED ----------	AWWA D103 - 97		
FLOOR O.D. ----------	25.250 ft	7696.200	mm

SUMMARY OF INTERNALLY ASSIGNED PARAMETERS

BOLT DIAMETER ----------	.500 in	12.700	mm
HOLE DIAMETER ----------	.5625 in	14.287	mm
TOP COURSE EDGE DIST ---------	1.000 in	25.400	mm
STEEL FLOOR IN FNDN ----------	.094 in	2.388	mm
DIST T/FTG TO B/FLR ----------	.000 in	.000	mm
TOTAL FNDN THICKNESS ---------	.094 in	2.388	mm
SHEET DENSITY ----------	590.000 pcf	9451.	kg/m3
STEEL ELASTIC MODULUS ---------	30000000. psi	206843.	MPa
STEEL FLOOR DENSITY ----------	590. pcf	9451.	kg/m3
NET SHEET WIDTH ----------	105.462 in	2678.735	mm
NET STANDARD SHEET HT. -------	54.990 in	1396.746	mm
STARTER PANEL HEIGHT ---------	56.378 in	1432.001	mm
INVENTORY FILE USED: ---------	8020149.DF		

25 14 AQUASTORE STRUCTURE DESIGN SUMMARY

COURSE	SHEET NUMBER	THICK in.	THICK mm	PLACE CODE	GEOM CODE	MAT CODE	LIMITING FACTOR(S)
1	1	.094	2.388	1	1101	1	0
2	2	.094	2.388	1	1101	1	0
FDN	3	.094	2.388	3	6100	1	0

ANCHORS REQUIRED:
NONE

STRUCTURE DIAMETER	=	25.18 ft	7674.02 mm
HEIGHT OF STRUCTURE TO EAVE	=	13.95 ft	4250.89 mm
SLOSHING WAVE HEIGHT	=	.34 ft	104.64 mm
VOLUME OF STRUCTURE TO EAVE	=	6943. cu ft	197. m3
VOLUME OF CONTENTS	=	6694. cu ft	190. m3
VOLUME OF CONTENTS	=	50078. gal	189565. L
VOLUME OF STEEL FLOOR FND.	=	4. cu ft	0. m3
WEIGHT OF EMPTY CYLINDER ABOVE FLOOR	=	5068. lb	2299. kg
WEIGHT OF ROOF	=	0. lb	0. kg
SNOW (LIVE) LOAD	=	0. lb	0. kg
WEIGHT OF CONTENTS	=	417733. lb	189480. kg
STEEL FLOOR WEIGHT	=	2314. lb	1050. kg
TOTAL WEIGHT ON FOOTING	=	425115. lb	192829. kg
WIND SHEAR AT TOP OF FOOTING	=	0. lb	0. N
WIND MOMENT AT TOP OF FOOTING	=	0. ft-lb	0. kN-m
SEISMIC SHEAR AT TOP OF FOOTING	=	22216. lb	98822. N
SEISMIC MOMENT AT TOP OF FOOTING	=	130307. ft-lb	177. kN-m

HOOP STRESS ANALYSIS

COURSE	DEPTH FT	PRESS PSI	NET TENS	ALLOW TENS	HOLE BEAR	ALLOW BEAR	BOLT SHEAR	ALLOW SHEAR
			STRESS - PSI					
1	4.2	1.8	3952.	14566.	12271.	40500.	2937.	18163.
2	8.7	3.8	8300.	14566.	25770.	40500.	6169.	18163.
FND	13.4	5.8	12757.	14566.	39610.	40500.	9481.	18163.

AXIAL STRESS ANALYSIS

COURSE	AXIAL COMP	ALLOW COMP	HOLE BEAR	ALLOW BEAR	BOLT SHEAR	ALLOW SHEAR
		STRESS - PSI				
1	19.	1219.	189.	40500.	45.	18163.
2	38.	1219.	377.	40500.	90.	18163.
FND	57.	1219.	285.	40500.	68.	18163.

SEISMIC STRESS ANALYSIS

COURSE	AXIAL COMP	SEIS BEND	TOTAL COMP	ALLOW COMP	HOLE BEAR	ALLOW BEAR	BOLT SHEAR	ALLOW SHEAR
			STRESS - PSI					
1	19.	14.	33.	3029.	331.	54000.	79.	24217.
2	38.	85.	123.	3556.	1235.	54000.	296.	24217.
FND	57.	232.	288.	3821.	1449.	54000.	347.	24217.

SEISMIC STRESS ANALYSIS CONTINUED

COURSE	STRESS - PSI HDYN HOOP	TOTAL HOOP	ALLOW TENS
1	357.	4309.	19421.
2	514.	8813.	19421.
FND	565.	13322.	19421.

DOCUMENT NUMBER: 8020149 -011 REL.: 1 TITLE: TANK GENERAL NOTES

TANK DESIGN SPECIFICATIONS

This tank is designed in accordance with AWWA Standard D103-97.

COATINGS SPECIFICATIONS

Coatings used on components of this tank are in compliance with the appropriate sections of AWWA Standard D103.

STRUCTURE BOLT SPECIFICATIONS

Structure bolts are as defined in AWWA Standard D103 Sect. 2.2.1. All bolts are 1/2"-13 UNC-2A thread, carbon steel, zinc plated, and have the following minimum tensile strengths.

A. 1" Long	74 KSI	510 MPa
B. 1-1/4" Long and longer	150 KSI	1034 MPa

APPURTENANCE AND PIPING ORIENTATION

Orientation of all appurtenances and piping connections shall be established in the field.

THROUGH-THE-SHEET PENETRATIONS

All openings through the tank side wall greater than 4 inches (102mm) in diameter shall be reinforced in accordance with AWWA D103, Section 3.11.

All openings through sheets having less than 24 inches (610 mm) between horizontal bolt lines, or having less than 24 inches (610 mm) of available sheet space from the floor surface up to the first horizontal bolt line shall not exceed a diameter of 4 inches (102 mm). These openings of 4 inches (102 mm) and less shall be reinforced in accordance with AWWA D103, Section 3.11.

LADDER SPECIFICATIONS

The ladder system is manufactured in compliance with AWWA Standard D103 Section 5.4. In addition, the tank ladder side rails are fabricated from 6061-T6 aluminum while the ladder rungs are fabricated from 6061-T4 aluminum.

CATHODIC PROTECTION SPECIFICATIONS

This tank is equipped with a cathodic protection system. This system is designed to protect the items described below.

Entire submerged portion of tank sidewall and floor area including appurtenances supplied by the tank manufacturer.

Submerged uncoated metal objects not supplied by the tank manufacturer totaling: 0.0 sq. ft.

Submerged coated metal objects not supplied by the tank manufacturer totaling: 0.0 sq. ft.

This system is suitable for use in liquid having a resistivity of 500 ohm-centimeters. Field verification of resistivity limits is required after the tank is placed into service. The performance of the cathodic protection system may be adversely affected if the system is operated outside the resisitivity limits above.

The presence of submerged uncoated metallic items, for which cathodic protection has not been provided by the tank supplier, may also adversely affect the performance of the cathodic protection system. Electrical isolation and/or the determination of the cathodic protection requirements for such submerged items shall be the responsibility of the owner or the owner's designated agent. Tank warranty issues may also be affected.

For further information, refer to the instructions provided with the cathodic protection system.

DOCUMENT NUMBER: 8020149 -012 REL.: 1 TITLE: TANK FASTENER SCHEDULE

STRUCTURE BOLT QUANTITIES AT (H)ORIZONTAL & (V)ERTICAL SEAMS

	THRU THE SHEET FASTENERS						TRUSS FASTENERS		
BOLT LENGTHS: (mm) :	1" 25.40	1 1/4" 31.75	1 1/2" 38.10	1 3/4" 44.45	2" 50.80	2 1/4" 57.15	1 1/4" 31.75 C.S.	2 1/4" 57.15 C.S.	3" 76.20 C.S.
SEAM Wide H 1	0	194	40	0	0	0	0	0	0
SEAM V 1	225	0	0	0	0	0	0	0	0
SEAM Wide H 2	178	20	0	0	0	0	0	0	0
SEAM V 2	225	0	0	0	0	0	0	0	0
SEAM Fnd. H 3	180	18	0	0	0	0	0	0	0
ACCESS DOOR	0	0	30	0	0	0	0	0	0
REINFORCING PLT.	74	0	0	0	0	0	0	0	0
TOTALS:	882	232	70	0	0	0	0	0	0

DOCUMENT NUMBER: 8020149 -013 REL.: 1 TITLE: TANK SCHEMATIC

NOTE: ALL BRACKETS LOCATED AT TOP OF SPECIFIED RING

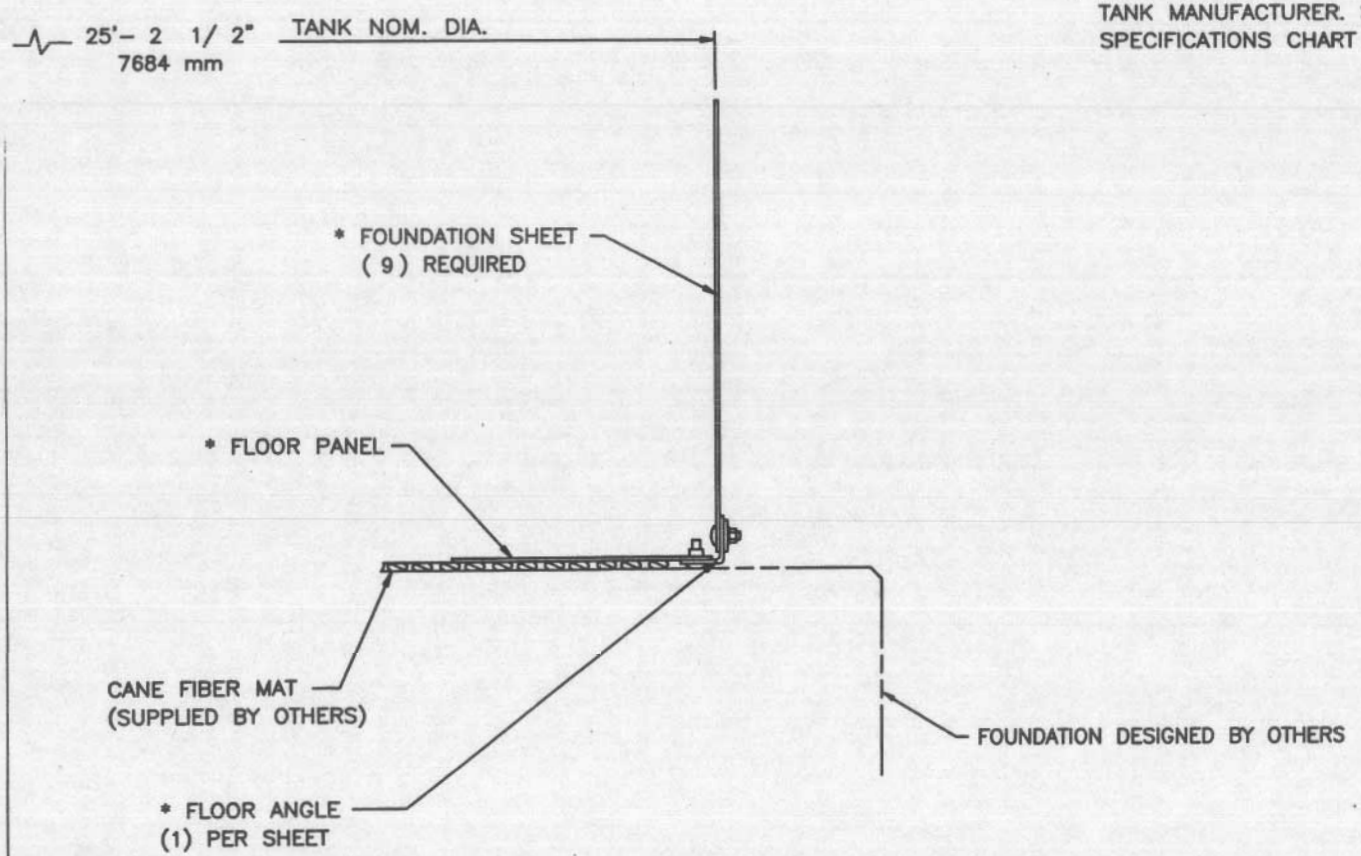
RING #	SHEET THICK.	BRKT. TYPE	QTY.
	Inside angle at top ring. Use tapered spacer at top horizontal seam		
RING #: 1....	.094.....	Y-BRKT.....	2
RING #: 2....	.094.....	Y-BRKT.....	2
FND. :	.094.....	Y-BRKT.....	2

NOTE: Tank color - Cobalt BLUE

ITEM	QTY.	PART NO.	DESCRIPTION
-	1	8020149-001	TANK ASSEMBLY
1	1	8020149-002	FOUNDATION ASSEMBLY
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17	1	263598-002	LADDER KIT (W/CAGE)
18			
19			
20			
21			
22			
23			
24			
25			
26			
27	9	258898-025	STIFFENER ANGLE
28	9	258899-003	SPLICE ANGLE
29	9	084373-000	TAPERED SPACER
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45	882	262000-001	STRUCTURE BOLT, 1", BLACK
46	232	262000-002	STRUCTURE BOLT, 1 1/4", BLACK
47	70	262000-003	STRUCTURE BOLT, 1 1/2", BLACK
48			
49			
50			
51			

ITEM	QTY.	PART NO.	DESCRIPTION
52			
53			
54			
55	1184	252275-000	WASHER, 1/2"
56	1184	262416-001	HEX. NUT, 1/2" HDZ
57			
58			
59	10	265777-203	SEALER 98, 20 oz POUCHES
60	2	264913-000	BUSS BAR
61	1	266681-000	ANODE INSPECTION/TESTING
62	2	266680-300	CATHODIC PROT. SYSTEM - ZINC
63			
64			
65	3	255495-000	INSTRUCTION DECAL
66	3	262778-000	DANGER DECAL
67			
68	1	266182-000	NAMEPLATE
69	1	262355-000	OPERATORS MANUAL
70	3	262166-000	IMPORTANT DECAL
71	3	260581-000	TANK MOD. WARNING DECAL
72	1	265307-000	INSPECTION & MAINT. REVIEW
73			
74	3	260910-000	"Y" BRACKET ASSY. SET (SHORT)
75			
76			
77			
78			
79			
80			
81			
82			
83			
84			
85	18	256047K0100	SHELL SHEET .094" HRS
86			
87			
88			
89			
90			
91			
92			
93			
94			
95			
96			
97			
98			
99			
100			
101			
102			
103			
104			
105			
106			

NOTES:
1. THIS DRAWING IS NOT TO SCALE.
2. ITEMS INDICATED * TO BE SUPPLIED BY THE TANK MANUFACTURER. SEE * ESPC PARTS SPECIFICATIONS CHART ON THIS DRAWING.



SECTION THROUGH FOUNDATION

REL	DESCRIPTION
1	REL PER MIP 8020149 01/28/02

* ESPC PARTS SPECIFICATIONS		
FLOOR ANGLES	IN.	3 X 3 X 1/4
	mm	76 X 76 X 6

ENGINEERED STORAGE PRODUCTS COMPANY
DEKALB, ILLINOIS 60115

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FILE: 8020149B

DRAWN BY TAK
DATE 01/28/02

25' SF FND
SZ 1
POND INLET
(NUNAVIK)
ONTARIO, CANADA

DRWG NO. 8020149-002

DOCUMENT NUMBER: 8020149 -023 REL.: 1 TITLE: FOUNDATION PARTS LIST

NOTE: Tank color - Cobalt BLUE

ITEM	QTY.	PART NO.		DESCRIPTION
-	1	8020149	002	S.F. FOUNDATION ASSY.
1	8	266688K0100		.0940" FND. SHT. HRS
2	1	263748K0100		25 FT. DIA. FLOOR ASSEMBLY
3				
4	1	266216K0137		ACCESS DOOR SHEET
5	1	259813-025		24" ACCESS DOOR ASSEMBLY
6	1	266214-1300		REINFORCING PLATE
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18	38	265777-	203	SEALER 98, 20 oz (BLACK)
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33	45	263156-001		ENCAPSULATED NUT, PLASTIC
34				
35				
36				
37	225	262000-001		STRUCTURE BOLT 1", BLACK
38	360	262000-002		STRUCTURE BOLT 1 1/4", BLACK
39	54	262000-003		STRUCTURE BOLT 1 1/2", BLACK
40				
41	639	262416-001		HEX NUT, 1/2" HDZ
42	654	252275		WASHER, 1/2"

ITEM	QTY.	PART NO.	DESCRIPTION
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57	1	266346K0100	CENTER COVER PLATE
58			
59			
60			
61			
62			
63			
64			
65			
66			
67			
68			
69			
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
80			

FOUNDATION BOLTS FASTENER SCHEDULE

(in) (mm)	1 25.41	1 1/4 31.75	1 1/2 38.10	1 3/4 44.45
ANCH. CHAIR	0	0	0	0
VERTICAL	225	0	0	0
HORIZONTAL	0	315	54	0

Engineered Storage Products Company

Manufacturer's
Extended Warranty

One-Year Warranty

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Any Warranty claim shall be made to ESPC in writing. Once a claim has been made, ESPC shall have the right to perform on-site inspections of the tank. If ESPC is required to do repair work (which, for purposes of this paragraph, shall include repairing or replacing defective parts or corroded sheets) on the tank, ESPC shall be granted permission to perform such work with its own service personnel or personnel of others, and under nonunion conditions unless ESPC otherwise agrees. Any repairs made to a tank before ESPC is notified of a claim shall be at the Owner's expense. Preparation for inspection or repair of a tank (such as removing the contents and obstructive equipment in the tank) shall be the sole responsibility and expense of Owner. Preparation of the tank for use after repair (such as sanitation of the tank and reinstallation of equipment) shall also be the sole responsibility and expense of Owner.

Disclaimers

EXCEPT FOR THE LIMITED WARRANTIES SET FORTH ABOVE, THERE ARE NO UNDERSTANDINGS, AGREEMENTS, REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, RESPECTING THE AQUASTORE BRAND LIQUID STORAGE TANK. ESPC EXPRESSLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

ESPC's Authorized Dealers are independent contractors and are not agents or employees of ESPC. No statement by any ESPC Authorized Dealer or any ESPC employee shall constitute an understanding, agreement, representation or warranty by ESPC. ESPC makes no warranty with respect to goods manufactured by others, even if sold by an ESPC Authorized Dealer.

These Limited Warranties and related limitations and disclaimers cannot be modified or amended by an ESPC Authorized Dealer, and can be modified or amended only by a written document signed by an authorized ESPC employee.

ENGINEERED STORAGE PRODUCTS COMPANY

345 Harvestore Drive
DeKalb, Illinois 60115-9607 U.S.A.
815-756-1551 Phone, 815-756-7821 Fax

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ESPC P/N 265015-000 Rel. 4 ECN 01097

Construction Tender

Project No: 4-002-450

Name of Project: PANGNIRTUNG SEWAGE TREATMENT PLANT

Project Location: PANGNIRTUNG, NUNAVUT

Government of Nunavut

Revised: April 2002

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INSTRUCTIONS TO TENDERERS

1. INSTRUCTIONS

.1 Tenders are to be sealed and should be submitted in the envelopes provided.

.2 Tender envelopes must show the Project Name, Closing Date, Name and Address of the Tenderer on the **Exterior** of the Envelope.

.3 Tenders must be submitted on the forms provided.

.4 Failure by the Tenderer to comply with these Instructions to Tenderers may result in the tender submitted being disqualified. Disqualification shall be at the sole discretion of the Owner.

2. RECEIPT OF TENDERS

.1 Tenders must be received at the Tender Address by the Owner on or before the exact time and date fixed for their receipt.

.2 Any Tenders received after the closing time shall be rejected and returned unopened to the Tenderer. If only one Tender is received and that Tender is received late, the Tender may be accepted at the sole discretion of the Owner.

.3 Tenders shall be opened as soon as practicable after the tender closing time in accordance with Instruction 4.4.

.4 Tenders received by facsimile, except as permitted elsewhere in this tender, will not be accepted and if received shall be disqualified.

3. AMENDMENTS TO TENDERS

.1 Amendments to a tender by letter, facsimile or other written means are acceptable provided that the amendment:

(.i) Is received on or before the exact time and date fixed, for the receipt of Phase I of the Tender (except for amendments to Appendix B-2 Substantiation of Bid Adjustment) and;

(.ii) Contains the tender reference, closing date, name and address of the contractor and a signature.

.2 Amendments to tenders received by facsimile will be accepted by the Owner provided that the conditions included in Clause 3.1 are met and in addition:

(.i) Amendments to tenders are transmitted via the Owner's facsimile number:

	(867) 899-7327	in	**Pond Inlet, Nunavut**
or	**(867) 975-5450**	in	**Iqaluit, Nunavut**

(.ii) The Owner shall not be held liable for any claim, demand or other action should a facsimile transmission be interrupted, not received in its entirety, received after the stated closing time and date, received by another facsimile unit other than stated herein, or for any other reason over which the Owner does not have control.

(.iii) The amendment should indicate only the applicable changes and in such a manner that the total bid is not revealed.

.3 Verbal instructions will not be considered as a valid instruction for tender purposes, nor shall they be considered as having any bearing upon the tender submission.

4. INUIT, LOCAL AND NUNAVUT INCENTIVES and Appendices "B-1" and "B-2"

.1 One of the priorities of the Owner is to ensure that materials, equipment, labour and other services of Local, Nunavut and Inuit businesses are used to the fullest extent practical on this project, therefore, the Owner has implemented the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy which shall apply on this contract. Tenderers are required to comply with the requirements of the NNI Policy and to submit the required information within the deadlines stipulated. A copy of the current NNI Policy is attached as Appendix J.

.2 The Tenderer shall show intention to not only meet the minimum levels of Inuit Labour prescribed in Appendix K of this tender, but also to use the maximum amount of Local, Nunavut and/or Inuit labour, and subcontractors and suppliers available. Failure to do so indicated by a comparison to other Tenderers may result in disqualification by the Owner as a non-responsive tender. A Contractor that for previous contracts with similar prescribed Inuit Labour had failed to meet the minimum prescribed Inuit Labour MAY be deemed "not responsible" (as defined in the Government Contract Regulations) for this tender.

.3 For purposes of this tender, Local shall be considered to be the community in which the work is undertaken unless noted otherwise in these Tender Documents.

.4 In order to comply with the requirements of this Tender and specifically those included in the "Instructions to Tenderers" Clause 4, the Contractor is required to complete the attached forms entitled Appendix "B-1" "General Contractors & Subcontractors Dollar Amount" and Appendix "B-2" "Substantiation of Bid Adjustment".

This Tender will close in two phases as follows:

Phase I Tender Close: The Contractor shall complete the Tender Form and all required appendices and shall submit them no later than the time identified for the Phase I closing of Tenders.
The Contractor shall indicate on the Appendix "B-1" "General Contractors & Subcontractors Dollar Amount" the bid value and names of all major businesses which will be providing goods and services to the Contractor in order to complete the Work. No further detail is required at the time of Phase I Tender closing.
At the time established for the Phase I Tender closing, the Owner shall receive Tenders and shall record the names of the Contractors who have submitted Tenders. **Those Tenders shall remain unopened and held in a secure place by the Owner for a period of 24 hours.**

Phase II Tender Close: Within 24 hours following the Phase I Tender close, excluding holidays and weekends, the Contractor shall supply to the Owner a detailed Appendix "B-2" "Substantiation of Bid Adjustments" showing the actual amounts of Local, Nunavut, Inuit and Other content in respect to Payroll, Material, Equipment, Transportation, Accommodation and Other Costs.

This detailed Appendix "B-2" "Substantiation of Bid Adjustments" shall be submitted in a sealed envelope **or by facsimile** with clear identification as to the name of the Tender and the Tenderer, and shall be received prior to the Phase II Tender close which shall be 24 hours, excluding holidays and weekends, after the Phase I Tender closing. Detailed Appendix "B-2" "Substantiation of Bid Adjustments" received late may be disqualified.

Bids shall be opened after the Phase II closing.

NOTE: **The Contractor shall only receive a bid adjustment when a completed Appendix "B-1" "General Contractors & Subcontractors Dollar Amount" and Appendix "B-2" "Substantiation of Bid Adjustments" have been submitted in accordance with the above. Tenders submitted without such a submission shall receive no bid adjustment at all.**

5. SCHEDULE OF UNIT PRICES

.1 The Tenderer shall submit a schedule of unit prices on Appendix "C" or Appendix "D" as appropriate. Unit prices shall include the cost to supply and install as appropriate, and include all statutory charges, overhead, profit and the Contractor's contingency allowance.

6. OPTIONS & SUBSTITUTIONS SPECIFIED BY THE OWNER - Appendix "E"

.1 Tenders shall be based on the materials, methods, firms and equipment named in the Specifications and this shall constitute the base bid. Where more than one material or manufacturer is specified, any one of those specified may be selected and included in base bid.

.2 The Owner may wish to consider options or substitutions to the base bid. When the Owner lists items in Appendix "E" " Contractors should indicate the effect on the stipulated price that each item makes to the base bid. The lowest acceptable tender may be determined by adding or deducting any or all of these items to the base bid. Failure to complete this Appendix "E" when requested may result in the tender being disqualified at the sole discretion of the Owner.

7. OPTIONS PROPOSED BY THE TENDERER - Appendix "F"

.1 Tenderers may propose their own option in Appendix "F". To be considered the following requirements shall be met:

(a) Total Tender amount quoted must be based on products specified and not on options.

(b) Options proposed shall be listed and any difference in price shown in the appropriate place on Appendix "F".

(c) Options proposed must allow for all changes and adjustments in other work as may be necessary to form a complete and finished job. No additional claims will be considered at a later date.

(d) Submissions must contain sufficient information to enable the Owner to determine the acceptability of such proposed options. Include such information as reasons for submission, manufacturing details, performance data, dimensions and clearances, effects on other work and other pertinent facts.

(e) The Owner reserves the right to accept or reject any option proposed by the Tenderer.

(f) By submitting an option on Appendix "F" the Tenderer relinquishes any proprietary right to such option. The Owner reserves the right to release the Option to other Tenderers in order to obtain competitive prices.

8. ADDENDA

.1 Addenda issued prior to the tender closing time shall be incorporated into the tender and shall become part of this tender. Receipt of addenda shall be acknowledged on the Tender Form by the Tenderer. Failure to acknowledge Addenda may result in the disqualification of the Tender at the sole discretion of the Owner.

9. TENDERING DOCUMENTS - Appendix "A"

.1 Tenders shall be based on the documents listed in Appendix "A" "List of Tender Documents".

13. WORKERS COMPENSATION ACT/COMPANIES ACT AND GENERAL COMPLIANCE WITH LAWS

.1 Tenderers are hereby notified that the Owner will check with the appropriate agencies prior to award of a contract to ensure that the successful Tenderer complies with the Workers Compensation and Companies Acts.

.2 The Contractor shall be required to comply, and shall require its subcontractors to comply, with all applicable laws, orders, rules and regulations; and, without limiting the generality of the foregoing, the Contractor shall at its sole expense comply with all unemployment insurance, Worker's Compensation, income tax, payroll tax, Canada Pension Plan, occupational health and safety and environmental protection legislation.

14. COMMERCIAL ROOM AND BOARD

On Contracts where a Commercial Room and Board Facility exists within the community, the Contractor is required to use a commercial room and board facility to house and feed all workers directly employed by the Contractor and by any subcontractor or agent or any other business working on the project. The Contractor is not required to use commercial room and board facilities for workers who maintain their primary residence in the community or stay in their primary residence and commute to the project location by land, water or air on a daily basis. Where the following definitions shall apply:

.1 Commercial Room and Board Facility

(a) means a facility that is:
- operated by a Nunavut business and is
- licensed by the Government of Nunavut under the Travel and Tourism Act as a "tourist establishment", and is
- licensed by the Government of Nunavut under the Eating or Drinking Place Regulation, and
- meets all of the requirements of the Fire Protection Act, the Public Health Act and any other applicable Government of Nunavut or federal legislation.

(b) means a facility that is not a bed and breakfast facility:

Where there is no Commercial Room & Board facility available, the Owner may direct the Contractor to use a Bed & Breakfast facility which provides a comparable service and standard to a qualified Commercial Room & Board facility. The utilization of any other room and board facility must be approved by the Owner.

.2 Community

means the community in which the work is located as defined in the contract and includes the entire area within a 20-kilometre radius of the community.

15. STORAGE OF PROPANE CYLINDERS

.1 The successful Tenderer is advised that they are responsible for the proper care and storage of propane cylinders on the job site in accordance with the Nunavut Fire Prevention Act. The penalty for non-compliance is up to $10,000 fine and/or 1 year jail term.

A copy of the Nunavut Fire Prevention Act is available by contacting:

The Fire Marshall's Office
Department of Community Government and Transportation
Government of Nunavut
Tel: (867) 975-5316 Fax: (867) 975-5330

10. BID SECURITY AND INSURANCE REQUIREMENTS

.1 When Tendering

(a) **For a Tender Less than $100,000:** No bid security accompanies this tender.

(b) **For a Tender $100,000 and Over:** The Tenderer shall enclose bid security in accordance with
either:

(i) a Bid Bond, in a form approved by the Federal Treasury Board and from a company whose bonds are acceptable to the Owner, in an amount of at least 10% of the Tender. Bonds shall be made payable to the Owner or;

(ii) a bid security deposit in an amount of at least 5% of the tender. The deposit must be a certified cheque, Bank Draft, a bank Irrevocable Letter of Guarantee, or such other bid security as the Owner considers acceptable. The bid security deposit must be payable to the Owner.

(c) The bid security deposit, as indicated above, may be forfeited at the discretion of the Owner if the Tenderer refuses to enter into a contract when called upon to do so.

(d) The Tenderer understands that if the bid security furnished is not in the approved form, as described herein, the tender is subject to disqualification at the sole discretion of the Owner

.2 Upon Award of Contract

(a) Upon notification of acceptance of a Tender, the successful Tenderer shall furnish within 14 days of the date of the notification of acceptance:

(i) The security specified in Clause GC56 to GC57 inclusive of the attached contract.

(ii) The Insurance specified in Clause GC58 to GC 62 inclusive of the attached contract.

11. SIGNATURES

.1 Tenders are to be properly signed and executed in accordance with the Laws of Nunavut.

.2 The Tenderer, or the person or persons duly authorized to sign on his behalf, must initial and date each and every correction, change, erasure or alteration contained in this completed tender document.

.3 At the sole discretion of the Owner, the failure by the Tenderer to properly sign and execute the tender may result in the disqualification of the tender.

12. GOODS AND SERVICES TAX

.1 The Tenderer shall exclude the Goods and Services Tax from his bid **shown** ***on bid forms and appendices***.

.2 ***The Government of Nunavut will pay the Goods and Services Tax (GST); however, do not include the GST in your bid amounts shown on the tender form and appendices.***

.3 ***The successful Tenderer may invoice for Goods and Services Tax (GST).***

.4 Further information in this regard may be obtained from the Owner at the specified Tender Address.

16. TRANSPORTATION

.1 The Contractor is to comply with requirements of Appendix "H" titled "Transportation of Materials".

17. AVAILABILITY OF OWNER STOCKPILED GRANULAR MATERIAL

The GN established a Granular Program Revolving Fund where various types of granular material have been stockpiled in some communities in Nunavut, for use in GN projects.

For all projects where the use of granular material is required, the following provisions shall apply:

a) The Contractor shall contact the appropriate regional contact to find out whether the community where the project is taking place is a community where granular material is stockpiled pursuant to the GN Granular Program Revolving Fund.

b) The numbers for regional contacts are as follows:

Regional Project Manager
Department of Public Works & Services
Baffin Region
Pond Inlet, NU X0A 0S0
PHONE: (867) 899-7303
FAX: (867) 899-7328

Regional Project Manager
Department of Public Works & Services
Kivalliq Region
Rankin Inlet, NU X0C 0G0
PHONE: (867) 645-8176
FAX: (867) 645-8196

Regional Project Manager
Department of Public Works & Services
Kitikmeot Region
Cambridge Bay, NU X0E 0C0
PHONE: (867) 983-7291
FAX: (867) 983-2158

c) Where the granular material as specified is available from GN stockpiles in the community of this contract, the contractor is encouraged to use GN granular material(s) for work under this contract.

d) The granular material is supplied to the contractor at no cost. However, all work and costs associated with the loading, transportation, interim storage and placement of the supplied granular material are the responsibility of the Contractor, unless otherwise noted.

18. ACCEPTANCE

.1 Tenders containing qualifications other than in the manner prescribed may be disqualified at the sole discretion of the Owner.

.2 The submission of the lowest or any tender will not necessarily result in the award of a contract. The Owner reserves the right to cancel this tender, in whole or in part at any time and to re-tender the same for any reason whatsoever without incurring any liability, and no bidder will have any claim against the Owner as a consequence.

.3 The Owner reserves the right to negotiate the tendered price solely with the low bidder (after adjustments in accordance with the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy), in order to achieve a reduced scope of work and price of up to 15%. The Owner further reserves the right to re-invite tenders from the low bidders without going to public tender in order to achieve a reduced scope of work greater than 15%, so long as the fundamental nature of the contract has not changed.

END OF INSTRUCTIONS TO TENDERERS

TENDER FORM

1. PROJECT INFORMATION

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

Project Owner: The Government of Nunavut, herein the "Owner", represented by the Minister of the Department of **Public Works and Services**

2. OFFER
(Information to be completed by Tenderer)

_____
Company Name

(herein the "Tenderer") offers to the Owner to furnish all necessary tools, plant, services, materials and labor to execute and complete in a careful and workmanlike manner the Work described in the Plans and Specifications for the prices as set out in Clause 4 or 5 of this Tender Form. The Tenderer hereby acknowledges receipt of Addenda No. _____ to No. _____ inclusive and hereby agrees they form part of this Tender.

3. GENERAL AGREEMENT
(Information to be completed by Tenderer)

The Tenderer agrees:

.1 To substantially perform the Work in compliance with the required completion schedule stated in the tender documents, or if no schedule is stated, to substantially perform the Work within _____ weeks from the date of notification of acceptance of the tender, or within a reasonable period of time after award;

.2 That he has carefully examined the Work described herein; has become familiar with local conditions and the character and extent of the Work; has carefully examined every part of the proposed contract and thoroughly understands its terms and conditions; has determined the sources of supply of the materials required; has investigated labor conditions and has arranged for the continuous performance of the Work described in the Tender Documents;

.3 That the list of Tender Documents included in Appendix "A" shall be and is the complete tender and this offer is made subject to all provisions contained therein;

.4 That this tender supersedes and cancels all communications, negotiations, and agreements relating to the Work other than contained in the completed tender.

4. FOR A CONTRACT BASED ON A LUMP SUM (Information to be completed by Tenderer)

The Tenderer agrees that the following is the lump sum referred to in Clause 2 of this Tender Form and that this is the Tenderer's total Tender price:

_____ DOLLARS ($_____)

An illegible submission may be disqualified at the sole discretion of the Owner. When there is a discrepancy between the written and numerical amount, the lowest version will govern.

5. FOR A CONTRACT PRICE BASED ON UNIT PRICES (Information on Appendix "D" to be completed by Tenderer)

(a) **For a Unit Price Contract, the Contractor shall complete Appendix "D".**

(b) For a unit price contract, the contract value shall be the Total Estimated Contract Price shown on Appendix "D".

(c) When an arithmetic error is identified on Appendix "D", the tendered Unit Price shall take precedence over the Total Estimated Contract Price and the Owner shall correct the arithmetic error as explained below.

(d) The Total Estimated Contract Price shall equal the sum of all Extensions (Column 6) for all items listed on Appendix "D". In the event that an arithmetic error is made in adding the individual Extensions listed in Column 6, the Owner shall correct the arithmetic error.

(e) Each Extension shall be equal to the Estimated Quantity (Column 3) multiplied by the tendered Unit Price (Column 5). In the event that an arithmetic error is made in multiplying the Estimated Quantity (Column 3) by the tendered Unit Price (Column 5) the Owner shall correct the arithmetic error including the Extension and the Total Estimated Contract Price.

(f) The Total Estimated Contract Price is based on estimated quantities; the final Contract amount owing to the Contractor shall be determined by taking the actual quantities that are incorporated in, or made necessary by the Work, as confirmed by count and measurement, and multiplying by the appropriate tendered Unit Price adjusted by any changes that are made in accordance with the provisions of the Contract Documents.

6. DECLARATIONS (Information to be completed by Tenderer)

The Contractor hereby declares that:

.1 No person, firm or corporation other than the undersigned has any interest in this Tender or in the proposed Contract for which the Tender is made, except as revealed by the tender or as may be required by the terms of this Contract for which the Tender is made;

.2 This Tender is irrevocable for a period of thirty (30) calendar days from the date of Phase I Tender Closing, as explained in Instructions to Tenderers 4.4;

.3 The Tenderer acknowledges that the Owner may extend the above thirty (30) day period to sixty (60) days provided that notification of extension is made within fifteen (15) calendar days of Phase I Tender Closing date, and that this extension shall result in an increase or decrease to the stipulated price of:

$_____ addition to stipulated price

or

$_____ reduction to stipulated price

(Any increase and decrease to the stipulated price, shall not be subject to an adjustment under the Nunavummi Nangminiqaqtunik Ikajuuti Policy.)

7. SIGNATURES (Information to be completed by Tenderer)

Signed, sealed and submitted for and on behalf of:

Company_____
(Full Legal Business Name)

_____
(Street Address)

_____
(Mailing Address)

_____
(Community, Territory/Province and Postal Code)

Signature _____

Name & Title _____

Dated at _____ this ___ day of _____, 20

Witness _____

Dated at _____ this ___day of _____, 20

END OF TENDER FORM

LIST OF TENDER DOCUMENTS

(Information to be completed by OWNER)

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

The following is the list or description of the tender documents referred to in the Tender for this Project.

Tender

1. Tender Advertisement
2. Instructions to Tenderers
3. Tender Form
4. Appendices to Tender: A, B, B-1, B-2, C, D, E, F, G, H, I, J and K
5. Addenda (issued during Tender period): Addendum# ____ to ____
   (list Addenda when preparing the contract documents after award)

Contract

1. Articles of Agreement
2. Terms of Payment
3. General Conditions
4. Special Provisions: _____
5. Drawings (list):

   As per Drawings Title Sheet and as seen in **Section 00050,** ***List of Contract Drawings***

6. Technical or General Specifications

   See Table of Contents with the Specifications

LOCAL/NUNAVUT/INUIT EMPLOYMENT AND TRAINING

Local/Nunavut/Inuit employment and training are high priorities with the Government of Nunavut (GN). General Contractors and Sub-contractors contracted for work on Government of Nunavut projects are required to hire Local and Nunavut and Inuit residents to the maximum extent possible. Information regarding available Local and Nunavut and Inuit workers can be obtained from a Federal Government Employment Centre, a Federal Government Outreach Centre, or Hamlet Office, and Education Department Career Centres of the Government of Nunavut.

Federal Government Employment Centres:

Location	Phone Number	Facsimile Number
Rankin Inlet	(867) 645-2853	(867) 645-2148
Iqaluit	(867) 979-6271	(867) 979-6070

Federal Government Outreach Centres or Hamlet Offices:

Location	Phone Number	Facsimile Number
Arviat	(867) 857-2678	(867) 857-2502
Qikiqtarjuaq (Broughton Island)	(867) 927-8832	(867) 927-8120
Cape Dorset	(867) 897-8943	(867) 897-8030
Clyde River	(867) 924-6220	(867) 924-6293
Pond Inlet	(867) 899-8935	(867) 899-8940
Cambridge Bay	(867) 983-2120	(867) 983-2570
Baker Lake	(867) 793-2517	(867) 793-2509
Taloyoak	(867) 561-6341	(867) 561-5057
Kuugaruk (Pelly Bay)	(867) 769-6281	(867) 769-6069
Kugluktuk (Coppermine)	(867) 982-4471	(867) 982-3060
Gjoa Haven	(867) 360-7141	(867) 360-6049
Igloolik	(867) 934-8830	(867) 934-8757
Pangnirtung	(867) 473-8953	(867) 473-8832

Training is encouraged on all construction projects and, in some tenders, will be made a contract requirement. Funding to offset training costs is provided through the Building and Learning strategy, the Apprenticeship Program, the Training On The Job Program and Women in Trades and Technology, and as a contract bonus pursuant to the Nunavummi Nangminiqaqtunik Ikajuuti Policy, Government of Nunavut. Contractors can obtain further information from the Education Department Career Centres, Government of Nunavut.

Education Department Career Centres, Government of Nunavut:

Location	Phone Number	Facsimile Number
Cambridge Bay	(867) 983-7214	(867) 983-2004
Iqaluit	(867) 975-5653	(867) 975-5670
Rankin Inlet	(867) 645-5039	(867) 645-2148
Igloolik	(867) 934-8192	(867) 934-8808

EMPLOYMENT REPORT

The successful General Contractor will be required to complete an Employment Report for ALL site employees that have worked on this project. The Contractor is required to complete a standard GN employment report.

A SAMPLE of the required Employment Report is attached on the following page. This form is available from the Owner.

This information **must** be submitted with each Progress Claim on contracts over $100,000.00 as well as with the Substantial Certificate of Completion, updated with the Final Certificate of Completion.

For projects under or equal to $100,000.00 the Employment Report must be submitted with the substantial Certificate of Completion, updated with the Final certificate of Completion. At the sole discretion of the owner, the information may be required with each Progress Claim.

It is the General Contractor's responsibility to obtain the required information from the sub-trades and sub-sub-trades.

The successful General Contractor shall comply with the requirements of Clauses GC52, GC53, GC54 and GC55. Specifically in respect to Clause GC54, if requested to do so by the Owner, the successful General Contractor shall be responsible to obtain an "Employee Verification and Consent Form" included as Appendix "B", page 4.

EMPLOYMENT REPORT

Project Name: Pangnirtung Sewage Treatment Plant	Project Location: Pangnirtung, Nunavut
General Contractor:	Project No: 4-002-450 Contract No:
Report Submitted by (General/Subcontractor):	Reporting Period From: To:

This Employment Report is Submitted With: *(CHECK ONE)*

☐ Progress Claim No. _____ Date:	☐ Substantial Certificate of Completion Date:	☐ Final Certificate of Completion Date:

Employee's Name	** Inuit Yes	** Inuit No	Employee's Address: (Street Address & Mailing if different)	Date Hired:	Date Terminated:	Hrs. Work. This Period:	Hours Worked To Date:	Gross Income This Period:	Gross Income To Date:	* Class

Contractors / Subcontractors Name & Title (Print) | Contractors / Subcontractors Signature: | Date:

* Classifications:

1. Superintendent	2. Carpenter	3. Carpenter Apprentice	4.Labourer	5. Mechanical	6. Mechanical Apprentice	7. Electrician	8. Electrical Apprentice	9. Drywaller/ Painter	10. Drywaller / Painter Apprentice	11. Other (specify)

**Beneficiary of the Nunavut Land Claim Agreement

EMPLOYEE VERIFICATION AND CONSENT FORM

TO: GOVERNMENT OF NUNAVUT (GN)

My full name is _____
(Print or Type)

My permanent home address is _____
(mailing and physical address)

_____

I am employed by _____

On _____
(Name or Description of Project)

I have lived in Nunavut for at least the past 12 months and in _____

_____ For at least the past 6 months.
(Community)

AND TO WHOM IT MAY CONCERN

I hereby authorize any Federal, Provincial or Territorial government department or agency to release particulars and/or a copy of my Nunavut Health Care Card, Nunavut Driver's License, Nunavut Motor Vehicle Registration, Nunavut General Hunting Licensc, and Nunavut Tungavik Inc. (NTI) to release my Beneficiary number or card, or any other documentation which the GN may deem helpful or necessary in verifying my place of residence or Beneficiary status.

_____ _____
(Witness) (Employee Signature)

Signed _____, _____
(Date) (Year)

BID ADJUSTMENT INFORMATION

- This contract shall be awarded to the Tenderer who is responsive and responsible (as defined in the Government Contract Regulations) and who has submitted a tender that, after the application of any tender adjustment permitted under the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy, is lower than that submitted by any other responsive and responsible Tenderer. Bid and contract requirements have been developed to comply with the letter and the spirit and intent of the NNI Policy.

- If and when requested by the GN, the Tenderer shall, prior to award, provide the GN with any and all clarifications, substantiations or further explanation about the proposals made by the Tenderer in respect to Local, Nunavut, Inuit and other content contained in their bid and reflected on Appendices "B-1" and "B-2".

- Tenderers are required to identify the dollar value of Own Forces as well as to name **ALL** subcontractors/suppliers and to identify their dollar value.
- Amendments affecting the tendered price shall require the Tenderer to also amend Appendix "B-1" to reflect the change, prior to the Phase I tender closing.

- Dollar value of Own Forces/Subcontractors noted in Appendix "B-1" shall include all amounts listed in Appendix "B-2" (i.e. payroll, transportation, equipment, etc.) for the Tenderer and all subcontractors. B-2 amounts that exceed the B-1 amounts will not be considered for bid adjustment.

- Dollar value(s) for payroll on Appendix "B-2" shall include all payroll costs for all divisions of work identified as Own Forces.

- An approved Nunavut Business or Inuit Firm will only receive bid adjustments for subcontractors, suppliers, payroll, and other bid components for those parts of bid that are Own Forces, or that are subcontracted to approved Nunavut businesses and/or Inuit firms, or for payroll to Inuit or Nunavut Residents. Bid adjustments will not be given for those portions of the bid that are not Nunavut or Inuit content. The definition of "Nunavut Business", "Inuit Firm", "Inuit" and "Nunavut Resident" are to be those definitions in the NNI Policy Definitions Appendix.

- Any business that is not an approved Nunavut Business, two weeks prior to tender closing, or is not an approved Inuit Firm prior to tender close, will not receive a bid adjustment for their portion of the bid, with the exception of the Inuit and/or Nunavut Payroll components, and amounts listed on Appendix B-1 as subcontracted to Nunavut and/or Inuit firms approved by the foregoing deadlines. Payroll to Inuit and Payroll to Nunavut Residents, need not be supplied by an Inuit Firm or a Nunavut Business to receive a bid adjustment.

- A Tenderer (General Contractor) that is not a Nunavut Business or an Inuit Firm will only receive bid adjustments for Inuit and/or Nunavut Payroll amounts, and for amounts identified on Appendix B-1 as going to approved Nunavut Businesses and/or Inuit Firms. A completed Appendix B-2 for each named Nunavut Business and/or Inuit firm listed on Appendix B-1 must be submitted by the General Contractor for the Nunavut and/or Inuit subcontractor or supplier amounts to be eligible for bid adjustment.

- For companies listed as suppliers of materials, to receive the Nunavut bid adjustment, the company listed must be specifically approved by the GN for Supply of the applicable type of materials 2 weeks prior to the closing.

- to be eligible for an extra adjustment for"Local", the bid amount must first be eligible for an adjustment as a Nunavut business, or an Inuit firm.

General Contractors & Sub-Contractors Dollar Amount

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

Tenderers are required to identify the dollar value of Own Forces as well as ALL Sub-Contractors that will be involved in the completion of this project. This Appendix MUST be submitted no later than the time and date set for the Phase I tender closing. If this Appendix is not submitted or is incomplete the tenderer may be disqualified. By signing this Tender, the Tenderer is certifying that the information on this Appendix is correct. Changes to this information will not be accepted after Phase I Tender Closing. The owner reserves the right to ask the tenderer for substantiation of information provided.

General Contractor: (Full Business Name)	**Own Forces Amount: ($)**
	$
Sub-Contractors: (Full Business Name)	**Sub-Contract Amount: ($)**
1.	$
2.	$
3.	$
4.	$
5.	$
6.	$
7.	$
8.	$
9.	$
10.	$
Other(s)	**Amount: ($)**
1.	$
2.	$
3.	$
4.	$
5.	$
TOTAL	$

SUBSTANTIATION OF BID ADJUSTMENT - APPENDIX B-2

Project Name: Pangnirtung Sewage Treatment Plant
Project Location: Pangnirtung Nunavut
Project Number: 4-002-450
General Contractor:

This Appendix must be received within 24 hours of the Phase I tender close. To receive bid adjustments, as per the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy, all tenderers **MUST** complete this form. The Nunavut, Local and Inuit firm status, as defined by the NNI Policy, of named companies will be verified by the owner. The owner reserves the right to request substantiation of information provided. No changes with respect to this information will be allowed without written authorization of the owner. Dollar value for payroll shall include all divisions of work identified as own forces.

General Contractor (full business name):

Payroll	Local Nunavut Residents	Nunavut Res. (excl. Local)	Local Inuit Beneficiaries	Inuit Benficiaries (excl. Local)	Total $ Inuit Payroll	% Inuit of Total Payroll	Other Payr. - not Nunavut or Inuit	**Total Payroll**
	$	$	$	$	(for GN use)	(for GN use)	$	$
Cost Components (excluding Payroll) Identify Work to be Completed by own forces or Name Subcontractor/ Supplier	***Nunavut Firms** (not NTI approved Inuit) Local & Nunavut (excluding Inuit)	Nunavut (excl. Local & Inuit)	***Nunavut & **Inuit Firms** (GN & NTI approved) Inuit & Local & Nunavut	Inuit & Nunavut (excluding Local)	****Inuit Firms** (not GN approved Nunavut) Inuit & Local	Inuit (exluding Local)	**Other** (not GN or NTI approved firm)	* approved by GN ** approved by NTI **Total each Line**
General Expenses:	$	$	$	$	$	$	$	$
Accommodation:	$	$	$	$	$	$	$	$
Sealift:	$	$	$	$	$	$	$	$
Other Transportation:	$	$	$	$	$	$	$	$
Sitework:	$	$	$	$	$	$	$	$
Framing/Structural:	$	$	$	$	$	$	$	$
Name the Material Supplier(s) below	Note: Business must be specifically approved by the GN for supply of applicable product to receive Nunavut bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
List Miscellaneous Expenses below	Note: The name of the applicable company, or an indication of "own forces" must be given, to be considered for bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
TOTALS: Payroll + Other Cost Components	$	$	$	$	$	$	$	$
Total $ and % Inuit Content (for GN use):								
This section for GN use: NNI adjustments: - 14% Nunavut, -3% Local, -3% Inuit — Amount Qualified for NNI Adjustment	$	$	$	$	$	$	$	$
Adjustment - %	17%	14%	20%	17%	6%	3%	0%	
NNI Adjusted	$	$	$	$	$	$	$	$

SUBSTANTIATION OF BID ADJUSTMENT - APPENDIX B-2

Project Name: Pangnirtung Sewage Treatment Plant
Project Location: Pangnirtung Nunavut
Project Number: 4-002-450
General Contractor:

This Appendix must be received within 24 hours of the Phase I tender close. To receive bid adjustments, as per the Nunavummi Nangminiqaqtunik Ikajuuti (NN.) Policy, all tenderers **MUST** complete this form. The Nunavut, Local and Inuit firm status, as defined by the NNI Policy, of named companies will be verified by the owner. The owner reserves the right to request substantiation of information provided. No changes with respect to this information will be allowed without written authorization of the owner. Dollar value for payroll shall include all divisions of work identified as own forces.

Mechanical Sub-Contractor (full business name):

Payroll	Local Nunavut Residents	Nunavut Res. (excl. Local)	Local Inuit Beneficiaries	Inuit Benficiaries (excl. Local)	Total $ Inuit Payroll	% Inuit of Total Payroll	Other Payr. - not Nunavut or Inuit	**Total Payroll**
	$	$	$	$	(for GN use)	(for GN use)	$	$
Cost Components (excluding Payroll) Identify Work to be Completed by own forces or Name Subcontractor/ Supplier	***Nunavut Firms** (not NTI approved Inuit)		***Nunavut & **Inuit Firms** (GN & NTI approved)		****Inuit Firms** (not GN approved Nunavut)		**Other**	* approved by GN ** approved by NTI
	Local & Nunavut (excluding Inuit)	Nunavut (excl. Local & Inuit)	Inuit & Local & Nunavut	Inuit & Nunavut (excluding Local)	Inuit & Local	Inuit (exluding Local)	(not GN or NTI approved firm)	**Total each Line**
General Expenses:	$	$	$	$	$	$	$	$
Accommodation:	$	$	$	$	$	$	$	$
Sealift:	$	$	$	$	$	$	$	$
Other Transportation:	$	$	$	$	$	$	$	$
General Plumbing:	$	$	$	$	$	$	$	$
Sprinklers:	$	$	$	$	$	$	$	$
Insulation:	$	$	$	$	$	$	$	$
Sheet Metal:	$	$	$	$	$	$	$	$
Controls:	$	$	$	$	$	$	$	$
List Material Supplier(s) below	Note: Business must be specifically approved by the GN for supply of applicable product to receive Nunavut bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
List Miscellaneous Expenses below	Note: The name of the applicable company, or an indication of "own forces" must be given, to be considered for bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
TOTALS: Payroll + Other Cost Components	$	$	$	$	$	$	$	$
Total $ and % Inuit Content (for GN use):								
This section for GN use: NNI adjustments: - 14% Nunavut, -3% Local, -3% Inuit — Amount Qualified for NNI Adjustment	$	$	$	$	$	$	$	$
Adjustment - %	17%	14%	20%	17%	6%	3%	0%	
NNI Adjusted	$	$	$	$	$	$	$	$

SUBSTANTIATION OF BID ADJUSTMENT - APPENDIX B-2

Project Name: Pangnirtung Sewage Treatment Plant
Project Location: Pangnirtung Nunavut
Project Number: 4-002-450
General Contractor:

This Appendix must be received within 24 hours of the Phase I tender close. To receive bid adjustments, as per the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy, all tenderers **MUST** complete this form. The Nunavut, Local and Inuit firm status, as defined by the NNI Policy, of named companies will be verified by the owner. The owner reserves the right to request substantiation of information provided. No changes with respect to this information will be allowed without written authorization of the owner. Dollar value for payroll shall include all divisions of work identified as own forces.

Electrical Sub-Contractor (full business name):

Payroll	Local Nunavut Residents	Nunavut Res. (excl. Local)	Local Inuit Beneficiaries	Inuit Benficiaries (excl. Local)	Total $ Inuit Payroll	% Inuit of Total Payroll	Other Payr. - not Nunavut or Inuit	**Total Payroll**
	$	$	$	$	(for GN use)	(for GN use)	$	$
Cost Components (excluding Payroll) Identify Work to be Completed by own forces or Name Subcontractor/ Supplier	***Nunavut Firms** (not NTI approved Inuit)		***Nunavut & **Inuit Firms** (GN & NTI approved)		****Inuit Firms** (not GN approved Nunavut)		**Other**	* approved by GN ** approved by NTI
	Local & Nunavut (excluding Inuit)	Nunavut (excl. Local & Inuit)	Inuit & Local & Nunavut	Inuit & Nunavut (excluding Local)	Inuit & Local	Inuit (exluding Local)	(not GN or NTI approved firm)	**Total each Line**
General Expenses:	$	$	$	$	$	$	$	$
Accommodation:	$	$	$	$	$	$	$	$
Sealift:	$	$	$	$	$	$	$	$
Other Transportation:	$	$	$	$	$	$	$	$
General Electrical:	$	$	$	$	$	$	$	$
Fire Alarm Systems:	$	$	$	$	$	$	$	$
Lighting Control Equip.:	$	$	$	$	$	$	$	$
Security System:	$	$	$	$	$	$	$	$
Controls:	$	$	$	$	$	$	$	$
List Material Supplier(s) below	Note: Business must be specifically approved by the GN for supply of applicable product to receive Nunavut bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
List Miscellaneous Expenses below	Note: The name of the applicable company, or an indication of "own forces" must be given, to be considered for bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
TOTALS: Payroll + Other Cost Components	$	$	$	$	$	$	$	$
Total $ and % Inuit Content (for GN use):								
This section for GN use: NNI adjustments: - 14% Nunavut, -3% Local, -3% Inuit — Amount Qualified for NNI Adjustment	$	$	$	$	$	$	$	$
Adjustment - %	17%	14%	20%	17%	6%	3%	0%	
NNI Adjusted	$	$	$	$	$	$	$	$

Form Date: March 2001

SUBSTANTIATION OF BID ADJUSTMENT - APPENDIX B-2

Project Name: Pangnirtung Sewage Treatment Plant
Project Location: Pangnirtung Nunavut
Project Number: 4-002-450
General Contractor:

This Appendix must be received within 24 hours of the Phase I tender close. To receive bid adjustments, as per the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy, all tenderers **MUST** complete this form. The Nunavut, Local and Inuit firm status, as defined by the NNI Policy, of named companies will be verified by the owner. The owner reserves the right to request substantiation of information provided. No changes with respect to this information will be allowed without written authorization of the owner. Dollar value for payroll shall include all divisions of work identified as own forces.

Other Sub-Contractor (full business name):

Payroll	Local Nunavut Residents	Nunavut Res. (excl. Local)	Local Inuit Beneficiaries	Inuit Benficiaries (excl. Local)	Total $ Inuit Payroll	% Inuit of Total Payroll	Other Payr. - not Nunavut or Inuit	**Total Payroll**
	$	$	$	$	(for GN use)	(for GN use)	$	$
Cost Components (excluding Payroll) Identify Work to be Completed by own forces or Name Subcontractor/ Supplier	***Nunavut Firms** (not NTI approved Inuit) Local & Nunavut (excluding Inuit)	Nunavut (excl. Local & Inuit)	***Nunavut & **Inuit Firms** (GN & NTI approved) Inuit & Local & Nunavut	Inuit & Nunavut (excluding Local)	****Inuit Firms** (not GN approved Nunavut) Inuit & Local	Inuit (exluding Local)	**Other** (not GN or NTI approved firm)	* approved by GN ** approved by NTI **Total each Line**
General Expenses:	$	$	$	$	$	$	$	$
Accommodation:	$	$	$	$	$	$	$	$
Sealift:	$	$	$	$	$	$	$	$
Other Transportation:	$	$	$	$	$	$	$	$
List Material Supplier(s) below	Note: Business must be specifically approved by the GN for supply of applicable product to receive Nunavut bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
List Miscellaneous Expenses below	Note: The name of the applicable company, or an indication of "own forces" must be given, to be considered for bid adjustment.							
1	$	$	$	$	$	$	$	$
2	$	$	$	$	$	$	$	$
3	$	$	$	$	$	$	$	$
TOTALS: Payroll + Other Cost Components	$	$	$	$	$	$	$	$
Total $ and % Inuit Content (for GN use):								
This section for GN use: NNI adjustments: -14% Nunavut, -3% Local, -3% Inuit — Amount Qualified for NNI Adjustment	$	$	$	$	$	$	$	$
Adjustment - %	17%	14%	20%	17%	6%	3%	0%	
NNI Adjusted	$	$	$	$	$	$	$	$

Note: for additional "Other Sub-contractors" use photocopies of this page

LIST OF UNIT PRICES
STIPULATED PRICE CONTRACTS ONLY

(Information to be Completed by Tenderer and Submitted with Tender)

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

The following are our unit prices for the units of work listed hereunder. The base price for the work is included in our tender; these unit prices apply only to variances of the estimated quantity.

TO BE COMPLETED BY THE GN			TO BE COMPLETED BY THE TENDERER	
Unit of Work			Unit Price ($)	
Item	Description	Unit	Addition	Deletion

LIST OF UNIT PRICES
UNIT PRICE CONTRACTS ONLY

(Information to be Completed by Tenderer and Submitted with Tender)

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

(a) The conditions in Tender Form, Clause 5.0 apply to the completion of this Appendix.

(b) If space for listing items is insufficient, the Owner shall annex a list and make reference to it on this form.

(c) Type or print tendered values clearly. An illegible submission may be disqualified at the sole discretion of the Owner.

TO BE COMPLETED BY THE GN				TO BE COMPLETED BY THE TENDERER	
1. No	2. Description	3. Estimated Quantity	4. Unit	5. Unit Price	6. Estimated Total Price
				Total Estimated Contract Price	

LIST OF OPTIONS & SUBSTITUTIONS
SPECIFIED BY THE OWNER

(To be Completed by Tenderer and Submitted with Tender)

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

In accordance with Clause 6 of the Instructions to Tenderers, indicate the effect on the stipulated price for the following options and substitutions listed by the Owner. The Tenderer further agrees that the following prices may be used in the evaluation of the submitted Tender.

All Options, Substitutions and Separate Prices shall include all work necessary for and incidental to the work described.

	Effect on Stipulated Price ($) (To be Completed by Tenderer and Submitted with Tender)	
Description of Options & Substitutions (To be Completed by the GN)	$ Addition to Stipulated Sum Price	$ Reduction to Stipulated Sum Price

LIST OF OPTIONS
PROPOSED BY THE TENDERER

(Information to be Completed by Tenderer and Submitted with Tender)

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

In accordance with Clause 7 of the Instructions to Tenderers, the Tenderer may propose options or substitutions below. The cost of such options and substitutions are NOT included in the stipulated price.

If this form is not used, the Tenderer should draw a line through the form and initial.

	Effect on Stipulated Price ($)	
Description of Options & Substitutions proposed by Tenderer	$ Addition to Stipulated Sum Price	$ Reduction to Stipulated Sum Price

PLANT AND EQUIPMENT LIST

(Information to be Completed by Tenderer and Submitted with Tender)

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

The following list is the complete description of plant and equipment I/We propose to use in the execution of this contract. Such plant and equipment will be made available for inspection prior to the award of contract. The plant and equipment shall be moved to the project site upon direction from the Owner and shall not be removed from the site until completion of the contract without written approval from the Owner.

Description of unit such as make, model, year and serial #.	Capacity such as size and horsepower rating	Auxiliary and/or special equipment, such as power take-off and power control units.	Condition	Present Location

TRANSPORTATION OF MATERIALS

1. Transportation/shipping and handling of materials and all costs thereof are the responsibility of the Contractor unless otherwise noted. **Modes of transporting materials shall be decided by the Contractor unless by marine transport in which case Clause 2 shall apply.**

2. Whenever marine (water) transport is to be utilized, the terms of the Carrier of Choice policy of the Owner shall be complied with. This policy provides that shipments to the following areas, if made by marine transport, shall be from the following carriers:

2.1 For Eastern Arctic Region, with the exception of Sanikiluaq. Communities (including Repulse Bay and Kugaaruk (Pelly Bay))

Contractor's must use the Government of Nunavut Eastern Arctic Sealift
Contact: Chris Cote at the N3 Alliance
Phone: Toll free: (866) 732-5438 (1-ton-sealift)
or
Iqaluit office tel: (867) 979-6825, fax (867) 979-0099

2.2 For Keewatin Region Communities (excluding Repulse Bay)

Northern Transportation Company Limited
P.O. Box 520
Hay River, NWT X0E 0R0
Phone: (867) 874-5100
Terminal: Churchill, Manitoba

2.3 For Kitikmeot Region Communities (excluding Kugaaruk (Pelly Bay))

Northern Transportation Company Limited
P.O. Box 520
Hay River, NWT X0E 0R0
Phone: (867) 874-5100
Terminal: Hay River, NWT

Marine transport from Hay River is to these Nunavut Communities: Cambridge Bay, Kugluktuk (Coppermine), Gjoa Haven, Taloyak

Space should be booked directly with the above carriers.

3. The GN has agreed to annual shipping rates and anticipated volumes for the Government of Nunavut Eastern Arctic sealift with the Government of Nunavut marine carrier. If anticipated volumes are not met damages may be incurred by the GN.

   Therefore the Contractor shall be responsible for extra freight cost, administrative costs or any other costs, incurred by the GN which result directly or indirectly from the Contractor's failure to use available ship cargos as required by this Appendix. The Contractor shall also be responsible to refund to the GN any monies saved by the Contractor by not using the Government of Nunavut Eastern Arctic Sealift carrier.

4. The GN has negotiated discounts with NTCL for the year 2001 shipping season for dry cargo destined to Kitikmeot Region communities described in paragraph 2.3 of this Appendix. The following discounts are available:

   4.1 Cargo received at the NTCL facility in Hay River two weeks prior to the published final acceptance dates for the destination will be afforded a 5% discount on shipping rates, and

   4.2 Nunavut Housing Corporation (NHC) Discount rates for all material crated to NHC crating specifications and delivered in the same manner i.e. in a single lot. Copies of the NHC crating specifications are available from the NHC Contracts Division at (867) 979-4421.

   The Tenderer should take all steps necessary to take advantage of these discounts.

CONTRACTOR'S CERTIFICATE OF INSURANCE

INSURED: _____

SCHEDULE OF MANDATORY INSURANCE			
Type of Insurance	**Insurer, Policy Number**	**Policy Period**	**Limit of Liability/Amount**
COMPREHENSIVE GENERAL LIABILITY INCLUDING NON-OWNED AUTOMOBILE LIABILITY		From: To:	BODILY INJURY $_____ Each Person $_____ Each Accident $_____ Aggregate Products PROPERTY DAMAGE $_____ Each Accident $_____ Aggregate Products **Or,** BODILY INJURY & PROPERTY DAMAGE $_____ Inclusive $_____ Aggregate Products
AUTOMOBILE LIABILITY (OWNED/LEASED VEHICLES)		From: To:	BODILY INJURY $_____ Each Person $_____ Each Accident PROPERTY DAMAGE $_____ Each Accident **Or,** BODILY INJURY & PROPERTY DAMAGE $_____ Inclusive
ADDITIONAL COVERAGES REQUIRED MARKED BY [ ]			
[ ] UMBRELLA LIABILITY		From: To:	$ Limits $_____ S.I.R.
[ ] CONTRACTOR'S EQUIPMENT		From: To:	
[ ] OTHER			

This is to certify that policies as described above have been issued through the undersigned to the Insured named above and are in force at this time. If cancelled or changed in any manner, for any reason, during the period of coverage as stated herein so as to affect this certificate, immediate written notice will be given by the undersigned to the Department.

PARTICULARS OF INSURANCE

GENERAL LIABILITY

[ ] Premises Property and Operations
[ ] Products and Completed Operations
[ ] Blanket Contractual - All Written Agreements
[ ] Occurrence Property Damage
[ ] Broad Form Property Damage
[ ] Contingent Employers Liability
[ ] Personal Injury
[ ] Employees as Additional Insureds
[ ] Cross Liability - Severability Of Interests
[ ] Blasting, Collapse, Underpinning
[ ] Exclusions deleted as follows:
[ ]
[ ]
[ ] Owners' & Contractors' Protective Liability

AUTOMOBILE LIABILITY

[ ] S.E.F. No. 4a Explosive Endorsement
[ ] S.E.F. No. 21b Blanket Fleet Endorsement
[ ]

[ ] **AIRCRAFT LIABILITY**
[ ]

[ ] **WATERCRAFT LIABILITY**
[ ]

REMARKS (STATE DEDUCTIBLES) IF ANY

THIS IS TO CERTIFY THAT INSURANCE AS DESCRIBED AS ABOVE IS IN FORCE AT THIS TIME.

Name and Address of Insurance Agent, Broker or Insurance Company

Written notice of any changes or cancellation of this policy shall be sent to the Owner at the following address:

Date _____

By _____
(Authorized Representative)

Nunavummi Nangminiqaqtunik Ikajuuti

Nunavummi Nangminiqaqtunik Ikajuuti

Prepared by

The GN / NTI Contracting Working Group

March 17, 2000

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Appendices

Appendix A: Definitions

Nunavummi Nangminiqaqtunik Ikajuuti

1.0 Coming Into Effect

1.1 This Policy is in effect on and after April 1, 2000 for every contract initiated on or after April 1, 2000.

2.0 Replacement

2.1 On its coming into effect, the Policy replaces the Nunavut Contracting Procedures for the Nunavut Settlement Area and the Nunavut Business Incentive Policy. Any guidelines or directives previously issued under those two replaced policies continue in effect until otherwise modified, but shall be interpreted so as to comply with the Policy.

3.0 Authority

3.1 In exercising its wider responsibilities and prerogatives, the Cabinet may, on an exceptional basis, depart from the application of provisions of the Policy.

4.0 Title:

4.1 The Policy is entitled the "Nunavummi Nangminiqaqtunik Ikajuuti" or "NNI Policy".

5.0 Application

5.1 Subject to sections 5.2 and 5.3, the Policy applies to the design, award, administration and interpretation of any Contract:

(a) to which the Government of Nunavut, or any of its Public Agencies or Public Boards as described in the Financial Administration Act is a party;

(b) where the Government of Nunavut provides, directly more than 51% of the total Contract funds; and,

(c) where the Government of Nunavut provides, directly more than 51% of the annual operating funds of one of the parties.

5.2 The Policy does not apply to:

(a) a contract that provides the Government of Nunavut with insurance against liability;

(b) a Government of Nunavut Employment Contract; or,

(c) a contract for the supply of emergency services,

5.3 Unless otherwise agreed by the Government of the Northwest Territories, the Policy does not apply to a contract where one of the parties is

1) a public body that is administered on behalf of the Government of Nunavut by the Government of the Northwest Territories; or,

2) a joint body of the Government of Nunavut and the Government of the Northwest Territories.

6.0 Definitions

6.1 Unless otherwise required by the context, terms used in the Policy have the meanings set out in Appendix A.

7.0 Policy Objectives

7.1 The Policy has the following objectives:

(a) Good Value and Fair Competition
To secure goods and services for the Government of Nunavut at the best value, recognizing the higher cost of doing business in Nunavut, and using a contracting process that is clear, fair and equitable.

(b) Strengthening the Nunavut Economy
To build the economy of Nunavut and its communities by strengthening business sector capacity and increasing employment.

(c) Inuit Participation
Subject to ss.16(2), to bring about a level of Inuit participation in the provision of goods and services to the Government of Nunavut that reflects the Inuit proportion of the Nunavut population.

(d) Nunavut Education and Training
Subject to ss.16(2), to increase the number of trained and skilled Nunavut Residents in all parts of the workforce and business community to levels that reflect the Inuit proportion of the Nunavut population.

8.0 The Bathurst Mandate

8.1 The Policy has been developed in a way consistent with the Government of Nunavut's 1999 Bathurst Mandate.

9.0 The Clyde River Protocol

9.1 The Policy has been developed in cooperation with Nunavut Tunngavik Incorporated in a way consistent with the "Protocol to Govern Working Relations Between the Government of Nunavut and Nunavut Tunngavik Incorporated" ('the Clyde River Protocol'), signed in November 1999

10.0 Relationship to Nunavut Land Claims Agreement (NLCA)

10.1 The Policy is aimed at implementing the Government of Nunavut's obligations under Article 24 of the NLCA.

10.2 The Policy shall be interpreted so as to respect to the letter and intent of the NLCA.

11.0 Evaluation Process and Bid Adjustment

11.1 The evaluation process for the award of Tenders and for the cost criteria portion of Requests for Proposals shall be as follows:

(a) all Tenders submitted should meet minimum contract requirements specified in the request for tender or proposal and should demonstrate a capability of carrying out the work;

(b) all Tenders meeting the requirements of 11.1.a and the cost criteria of relevant Proposals shall then be adjusted based upon Nunavut Business status, Inuit Firm status, and Local status of the proponent, general contractor, subcontractors, and suppliers, including the labour component;

(i) the adjustment for the labour component shall be based on estimates of payroll expenditures made by the general contractor, subcontractors and suppliers, for Nunavut, Inuit, and Local payroll expenditures that form part of the bid; and,

(ii) in the absence of any qualitative or contrary considerations based on quality of goods and services, conduct, past performance, or other like considerations, the lowest tender after adjustments shall be awarded the contract.

(c) the bid adjustment values shall be as follows:

(i) Nunavut firm status, an adjustment of 14%;

(ii) Inuit firm status, an additional adjustment of 3%;

(iii) Local status, an additional adjustment of 3%

11.2 The evaluation process for the award of Proposals shall be as follows:

(a) all Proposals submitted should meet minimum contract requirements specified in the Request For Proposals and should demonstrate a capability of carrying out the work;

(b) all proposals meeting the requirements of 11.2.a will be evaluated to determine which appears to offer the best overall value to the Government of Nunavut, based on the evaluation criteria established in the RFP;

(c) for Proposals where there is a clear cost criteria the bid adjustment values outlined in 11.1.c will be applied to that portion of the evaluation;

(d) Inuit content criteria will be included in the evaluation criteria established for each RFP. The Inuit content values shall be, at a minimum, as follows:

(i) for Inuit employment 10%

(ii) for Inuit ownership 5%

11.3 Details of the evaluation process shall be further described in procedures developed by the Responsible Department and made available to the public.

11.4 The bid adjustment values for goods contracts will be applied to the first $100,000.00 only.

11.5 Evaluation criteria, consistent with the Policy Objectives contained in 7.0, and based on the Bid Adjustment Values and Content Ratings identified in this section, may be developed by the Responsible Department for specific types of professional services contracts or other distinctive sub-categories of contract.

12.0 Bonuses and Penalties

12.1 Contracts may provide for:

(a) a bonus that shall be applied in the event that minimum threshold requirements set by the Contracting Authority in the request for tenders or proposals have been exceeded; or,

(b) a penalty that shall be applied in event that minimum threshold requirements set by the Contracting Authority in the request for tenders or proposals have not been met.

12.2 Where applicable, bonuses or penalties shall apply with respect to Inuit participation in employment, project management, and training.

12.3 Where applicable, in the area of employment, a bonus or penalty shall be calculated as 1/3 of 1% of the total labour content of the contract for each 1% of the amount by which employment either exceeds or does not meet the mandatory requirement.

12.4 Bonuses and penalties shall be calculated for Local Inuit Labour and/or Nunavut Inuit Labour.

12.5 In the area of Inuit management, a bonus or penalty in the amount of 2% of the total labour content shall be determined on the basis of whether an Inuk is employed as a Project Manager, either locally or for Nunavut. A larger bonus, but not a larger penalty, of an additional 1% shall be determined for a locally employed Inuk Project Manager than a Nunavut employed Inuk Project Manager.

12.6 Where applicable, a bonus or penalty shall be determined on the basis of on-going evaluation as to whether Inuit are provided training in the following areas:

(a) entry level or support positions, involving the performance of basic tasks; and,
(b) apprenticeship or development positions, involving on-the-job training and classroom instruction aimed at professional skills and accreditation;

12.7 Bonuses and penalties shall be determined for the provision of training to both non-Local Inuit and Local Inuit.

13.0 Maximum Bonuses and Penalties

13.1 The maximum total bonuses and penalties to be determined for a single Contract for employment, management, and training shall not exceed 25% of the total labour price.

14.0 Monitoring and Enforcement Procedures

14.1 Monitoring and enforcement procedures shall be developed and applied:

(a) generally, to ensure compliance with the Policy by Contractors;

(b) more specifically, to ensure that bonuses and penalties are based on actual performance;

(c) to ensure that the Policy is applied consistently across departments of the Government of Nunavut, the various regional and local offices of those departments, and those GN Public Agencies and Boards set out in the Financial Administration Act.

15.0 Application of Monitoring and Enforcement Procedures

15.1 Each Contract Authority within the Government of Nunavut is responsible for monitoring and enforcement of Contracts under which it expend funds.

15.2 Each Contract Authority within the Government of Nunavut shall provide monitoring and enforcement information to the Responsible Department in a manner that may be stipulated by that department.

15.3 The Government of Nunavut, through the Responsible Department shall provide Nunavut Tunngavik Incorporated with information in a timely manner regarding the outcomes of its monitoring and enforcement activities.

16.0 Periodic Review

16.1 It is recognized that achieving the objectives of the Policy will require consistent and persistent effort.

16.2 It is further recognized that the achievement of objectives may be most realistically and reliably secured by measured progress over time.

16.3 The substance and application of the Policy should therefore be reviewed and revised on a periodic basis to ensure that progress towards objectives is being made in a demonstrable and balanced way.

17.0 Review Committee

17.1 A Contracting Policy Review Committee, consisting of representatives appointed by the

Government of Nunavut and Nunavut Tunngavik Incorporated, shall be established to review the implementation of the Policy on a periodic basis and, in any event, at least on an annual basis.

17.2 As part of its mandate, the Review Committee shall develop and apply specific mechanisms for assessing progress towards objectives and making recommendations for adjustments to the Policy.

17.3 As part of its mandate, the Review Committee shall examine monitoring and enforcement concerns arising out of the implementation of the Policy.

17.4 The Review Committee will conduct a comprehensive review at the end of the first three-year period, and every five years thereafter

17.5 The Review Committee shall submit all of its work to the Government of Nunavut and Nunavut Tunngavik Incorporated.

17.6 In carrying out its work, the Review Committee shall make efforts to collect public input and to consult with interested parties. Without limiting the ability of the Committee to make other parts of its work available to the public, these annual and multi-year reviews shall in all cases be made available to the public.

18.0 Appeals and Arbitration

18.1 A Contractor that has submitted a proposal or Tender and that wishes to challenge an award of Tender or proposal may do so within five (5) days of the award announcement by directing the challenge to the Contracting Authority. The Contracting Authority shall have five (5) business days to respond to the challenge.

18.2 Any further challenge of an award shall be directed in writing to a Contracting Appeals Board.

18.3 An independent Contracting Appeals Board shall be formed, consisting of the representatives of three parties, appointed to terms of two years. A representative shall be appointed by each of the following :

i) the Government of Nunavut;

ii) Nunavut Tunngavik Incorporated; and,

iii) the Nunavut Chambers of Commerce.

18.4 The Board shall convene within 21 days of receiving a challenge.

18.5 Upon hearing a challenge, the Appeals Board may:

i) uphold the award; or

ii) recommend remedial actions.

18.6 The decision of the Appeals Board shall be binding and final.

18.7 If, in the sole opinion of the Appeals Board, a challenge of an award is frivolous or vexatious, then the Board may seek administrative costs against the party who brought the challenge.

18.8 An annual report, including financial statements, shall be prepared by the Appeals Board and submitted to the Government of Nunavut and to Nunavut Tunngavik Incorporated. In addition, these annual reports shall be made available to the public.

18.9 Notwithstanding that an appeal may be pending, the Contracting Authority may award the Contract.

19.0 Financial Resources

19.1 The expenditure of funds by the Government of Nunavut under the Policy is conditional on approval of such funds in the Main Estimates by the Legislative Assembly and on there being a sufficient uncommitted balance in the appropriated item for the fiscal year in which the expenditure is required, and on meeting such further requirements as may be set out in the Financial Administration Act.

20.0 Transition for Certain Businesses

20.1 The Government of Nunavut recognizes the contribution made to the Nunavut economy by a number of companies that have operated for many years in Nunavut that do not qualify as a Nunavut Business under this Policy. Accordingly, any business that, immediately before the coming into effect of the Policy, qualified as a Nunavut Business for the purpose of the Business Incentive Policy, shall qualify as a Nunavut Business under this Policy until the second anniversary of the coming into effect of this Policy.

20.2 For greater certainty, section 20.1 shall cease to have any application on the second anniversary of the coming into effect of the Policy and no business shall continue to qualify as a Nunavut Business or Inuit Firm unless it meets the definitions for those terms set out in Appendix A.

21.0 Revisions to or repeal of this Policy

21.1 Cabinet may make changes to this policy consistent with the obligations of the Government of Nunavut in Article 24 of the Nunavut Land Claims Agreement which requires a collaborative process with Nunavut Tunngavik Inc. in the maintenance of preferential procurement policies, procedures and approaches.

APPROVED BY CABINET

DATE:

Original is signed by the Premier

Paul Okalik, Premier

Includes Appendix A – Seven pages

APPENDIX A: DEFINITIONS

The following definitions apply to the Policy and its Procedures.

Article 23 - the Article of the Nunavut Land Claims Agreement dealing with Inuit Employment within Government.

Article 24 - the Article of the Nunavut Land Claims Agreement dealing with Government Contracts.

Bid - a tender or an offer to sell or provide goods, services, or construction that is submitted to a Contract Authority in response to a Request for Bids or Tenders.

Bid Adjustment - the amount by which the face value of a Bid is reduced in accordance with Section 6(2) of this Policy. The Bid Adjustment is used for Bid evaluation purposes only. The Bid price minus the Bid Adjustment will be referred to as the adjusted price.

Bid Security - security given by a Bidder or Proponent to guarantee entry into a Contract.

Bidder - an individual, partnership, corporation, society or co-operative who submits a Bid.

Contract - a written agreement between a Contracting Authority and another party to provide goods, perform services, construct public works, or lease real property, for consideration, and includes

i. Contracts for the supply of goods.

ii. construction Contracts.

iii. Contracts for the supply of services.

iv. leases.

Contract Authority - a Government of Nunavut Minister, a Deputy Minister, or a public officer with the duties and authorities set out in the Financial Administration Act and Regulations thereto.

Contract Price - the price or price formulated in a Contract.

Contract Security - a deposit of securities by the Contractor which the Contracting Authority may convert to carry out the Contractor's obligations under the Contract.

Contractor - a corporation, partnership or individual that has been awarded a Contract for the execution of work or services under the terms of a Contract.

DIO - Nunavut Tunngavik Incorporated or such other Inuit organizations that, from time to time, Nunavut Tunngavik Incorporated may, by notice to the Government of Nunavut, designate.

Employment Contract - a Contract which establishes an employer-employee relationship.

Financial Administration Act - the Financial Management Act, R.S.N.W.T 1990 (as adopted by Nunavut) c. F-3 and amendments thereto.

General Contractor - a Contractor who contracts to undertake an entire Contract, rather than a portion of the Contract.

Goods Contract - a Contract for the purchase of articles, commodities, equipment, goods, materials or supplies which may include installation.

Government - the Government of Nunavut.

Government of Nunavut - all Territorial Government departments and all public agencies defined by the Financial Administration Act, S.N.W.T. 1987 (1), c.16, Part IX, and Schedules A, B, and C, as amended for Nunavut pursuant to s.29 and 76.05 of the federal Nunavut Act but excluding the Northwest Territories Power Corporation.

Inuit (singular: Inuk) - a person described in Article 1.1.1 of the Nunavut Land Claims Agreement (NLCA) and who has enrolled himself or herself on the Inuit Enrolment List under Article 35 of the NLCA.

Inuit Content - the dollar value of the goods and services required by the Contract supplied by any Inuit Firm or Inuit sole proprietorship, and Inuit Labour. Inuit Content may include:

i. goods and services supplied by an Inuit Firm or Inuit supplier acting as the General Contractor. These are referred to as "own forces";

ii. goods and services supplied by an Inuit Firm or Inuit supplier so long as these goods and services are required for the completion of the Contract and are paid for by the Contract.

iii. Inuit labour by an Inuit Firm or a non-Inuit Firm

Inuit Enrolment List - the list of Inuit maintained by Nunavut Tunngavik Incorporated under Article 35 of the Nunavut Land Claims Agreement.

Inuit Firm - an entity which complies with the legal requirements to carry on business in the Nunavut Settlement Area, and which is

i. a limited company with at least 51% of the company's voting shares beneficially owned by Inuit, or
ii. a cooperative controlled by Inuit, or
iii. an Inuk sole proprietorship or partnership; and
iv. able to present evidence of inclusion on NTI's Inuit Firms Registry.

Inuit Firms Registry - the list of Inuit Firms that is maintained by Nunavut Tunngavik Incorporated in accordance with Article 24.7.1 of the Nunavut Land Claims Agreement.

Inuit Labour - labour, including professional services, provided in any capacity by an Inuk or Inuit, and not necessarily through an Inuit Firm.

Inuit Training – Training of an Inuk or Inuit related to a specific Contract that has been pre-approved by the Contract Authority.

Inuk Project Manager - an Inuk [ordinarily resident in the Subject Community] who is capable of undertaking all aspects of the management of the project, and has decision-making authority over day-to-day matters affecting the project.

Invite - to call publicly for Bids.

Local Business - a Nunavut Business which has been resident in the Subject Community for the four months prior to application and in addition complies with the following criteria:

i. maintains an approved place of business by leasing or owning office, commercial or industrial space or where applicable, residential space, in the community on a year-round basis for the primary purpose of operating the subject business, and
ii. maintains a Local Resident Manager, and
iii. undertakes in the Subject Community the majority of its management and administrative functions related to its operations in the Subject Community, and
iv. has applied for and received designation as a Local Business at least two weeks prior to the Tender opening.

Local Content - the goods and services required by the Contract and supplied by any Local Business or Local Labour. Local Content may include:

i. goods, services or labour supplied by a local business acting as the General Contractor. These are referred to as "own forces";

ii. goods, services or labour supplied by any other Local Business or Local Supplier that are required for the completion of the Contract and are provided for by the Contract.

Local Labour - labour of Local Residents related to a Contract, not necessarily through a Local Business.

Local Resident - a Nunavut Resident who has been ordinarily resident in the subject community for the last four months.

Local Resident Manager - a Local Resident who is capable of undertaking all aspects of the management of the Local Business and has absolute decision-making authority over day to day matters affecting the Local Business. The Government of Nunavut may waive this requirement in the case of a newly appointed Local Resident Manager, on proof that within six months the Local Resident Manager will have met the residency requirements.

Local Supplier - a supplier of goods in the Subject Community, to whom the public has access and from whom the public may purchase directly from a Representative Inventory of items

offered for sale. The supplier must be and must have been a Local Resident for the four months prior to application. The Government of Nunavut may recognize as a Local Supplier a business that does not "physically" carry in inventory specific goods due to factors such as high cost/low demand, made-to-order goods, or articles of a nature that the Government is the sole requisitioner.

Nunavummi Nangminiqaqtunik Ikajuuti (NNI) - the name of this Policy in Inuktitut, meaning "Assistance for Nunavut Businesses."

Nunavummi Nangminiqaqtunik Ikajuuti Business Directory - the list of Nunavut Businesses that have applied and met the requirements of the NNI for Nunavut Business Status.

Nunavut Business

A business which complies with the legal requirements to carry on business in Nunavut, and meets the following criteria:

i. is a limited company with at least 51 percent of the company's voting shares beneficially owned by Nunavut Residents, or
ii. is a co-operative with at least 51 percent of the Residents' voting shares beneficially owned by Nunavut, or
iii. is a sole proprietorship, the proprietor of which is a Nunavut Resident, or
iv. is a partnership, the majority interest in which is owned by Nunavut Residents and in which the majority benefits, under the partnership agreement, accrue to Nunavut Residents and complies with :

v. maintains a registered office in Nunavut by leasing or owning office, commercial or industrial space or in the case of service oriented businesses, residential space, in Nunavut on an annual basis for the primary purpose of operating the subject business, and
vi. maintains a Resident Manager, and
vii. undertakes the majority of its management and administrative functions related to its Nunavut operations in Nunavut, and
viii. has received designation as a Nunavut Business at least two weeks prior to the Tender opening.

Nunavut Content - the goods and services required by the Contract and supplied by any Nunavut Business or Nunavut Supplier. Nunavut Content may include:

i. goods, services or labour supplied by a Nunavut Business acting as the General Contractor. These are referred to as "Own Forces";

ii. goods, services or labour supplied by any other Nunavut Business or Nunavut Supplier that are required for the completion of the Contract and are paid for by the Contract.

Nunavut Resident - a person who:

i. is on the NTI Inuit Enrollment List; or has spent the last twelve months ordinarily resident in Nunavut, and
ii. has a valid Nunavut Healthcare Card and/or other accepted proof of residency such a Nunavut General Hunting Licence, a Nunavut Driver's Licence, a lease or rental receipt, and provides a physical address where residing.

Nunavut Supplier - a Nunavut Business that is a supplier of goods to which the general public has access and from whom the general public can purchase directly from a Representative Inventory of items offered for sale.

Nunavut Land Claims Agreement (NLCA) - the Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada, signed on May 25, 1993, and any amendments thereto.

Nunavut Tunngavik Incorporated (or NTI) - the corporation incorporated under the Canada Corporations Act, and the Inuit party to the Nunavut Land Claims Agreement.

Own Forces - goods, services or labour supplied by a Nunavut Business acting as the General Contractor.

Professional Services - services such as legal, accounting or consulting services provided to the Government of Nunavut by way of a Contract by an individuals or professional service companies.

Proponent - an individual, partnership, corporation or cooperative who submits a Proposal.

Proposal - an offer, either unsolicited or in response to a Request for Proposals, to propose a solution to a problem, need or objective, under stated terms and conditions.

Public Agency - any public agency defined by the Financial Administration Act, S.N.W.T. 1987 (1), c.16, Part IX, and Schedules A, B, and C, as amended for Nunavut pursuant to s.29 and 76.05 of the federal Nunavut Act, but excluding the Northwest Territories Power Corporation.

Public Board – Those boards defined as Public Boards in the Financial Administration Act Regulations concerning Government contracts.

Public Tender - a Request for Bids made by public advertisement.

Qualification Committees - committees in the Kivalliq, Kitikmeot, and Baffin Regions chaired by the Responsible Department, and responsible for determining the eligibility of businesses to be included on the **Nunavummi Nangminiqaqtunik Ikajuuti Directory.**

Request for Bids - a document defining the minimum standards to be met by Bidders and the specific requirements for goods, services or construction, so as to permit the comparison of Bids on the basis of price.
Request for Tenders - a document defining the minimum standards to be met by Tenderers and the requirements of the Contract so as to permit the comparison of Bids on the basis of price.

Request for Proposals - a document inviting companies to propose a solution to a problem, need or objective, so as to permit the comparison of proposals on the basis of a number of factors including price.

Representative Inventory - for a company that is a supplier of goods, an inventory stored in the community where the company is located, that consists of the type of goods that the supplier deals in. The inventory volume should be large enough to generally to meet the demand of Local and Nunavut Residents and is to be re-stocked as goods are sold so that goods are usually available off the shelf.

Resident Manager - a Nunavut Resident who is capable of undertaking all aspects of the management of the Nunavut Business and has absolute decision making authority over day-to-day matters affecting the Nunavut Business. The Government of Nunavut may waive this requirement in the case of a newly appointed Resident Manager, on proof that within six months the Resident Manager will have met the residency requirements.

Responsible Department - The Department of the Government of Nunavut which holds responsibility for implementing the Nunavummi Nangminiqaqtunik Ikajuuti Policy.

Security - cash, a bank draft or certified cheque payable to the Government, or such other Security specified in the Request for Tender or Contract documents.

Solicit - to request Bids from a limited number of businesses based on some form of pre-qualification.

Standing Offer Agreement - a method of supply used to provide direct access to sources of supply for goods and/or services, on an as-needed basis, for specific periods of time, at prearranged prices and delivery conditions.

Subcontractor - includes any party that does not have a direct Contract with the owner, **or** has entered into a Contract with the General Contractor to supply goods or services that will be incorporated into the entire project covered by the Contract.

Subject Community - the community or communities wherein or adjacent to where the Contract performance is undertaken. Where the work is undertaken outside the legal boundaries of a community, the Government of Nunavut may:

i. define "community" to include that adjacent community in any case, or
ii. define "community" to include both or all adjacent communities, where two or more communities, such as Hall Beach/Igloolik and Arctic Bay/Nanisivik, are both very close to the work site.
iii. The name(s) of the Subject Community or Communities to be included in the term "Subject Community" for the purpose of receiving a local preference shall be specified in all Tender documents and Contracts.

Tender - a Bid or offer to sell or provide goods, services, or construction that is submitted to a Contract Authority in response to a Request for Bids or Tenders.
Tenderer - a person, partnership or corporation who submits a Tender.

Tender Adjustment - the amount by which the face value of a Tender is reduced in accordance with Section 6(2) of this Policy. The Tender Adjustment is used for Bid evaluation purposes only. The Tender price minus the Tender Adjustment will be referred to as the adjusted price.

Training - training related to a specific Contract, that has been pre-approved by the Contract Authority.

APPENDIX K

CONTRACTOR'S OBLIGATIONS TO PROVIDE INUIT CONTENT

Project Title: **Pangnirtung Sewage Treatment Plant**

Project Location: **Pangnirtung, Nunavut** Project Number: **4-002-450**

1.0 GENERAL

This contract pertains to work in Nunavut and contains provisions regarding minimum prescribed levels of Inuit Labour that must be met or exceeded in the performance of the work. The requirements set out in this Appendix K to meet minimum prescribed levels of Inuit Labour is a fundamental term of the contract. The minimum prescribed level of Inuit Labour shall be complied with.

If the amount of Inuit Labour identified by the bidder on Appendix "B-2" of the tender is inconsistent with the tender requirements, this would result in an obvious qualification to the tender submission by the bidder that would ordinarily cause the tender to be considered non-responsive.

For an Inuit Labour level achieved which differs from the level prescribed, a bonus or penalty will be assessed in accordance with the NNI Policy, specifically Articles 12.3 and 12.4 of the Policy. A bonus would be for exceeding the minimum prescribed Inuit Labour level, and a penalty would be for not meeting the minimum prescribed Inuit Labour level.

"Inuit Labour" and "Inuit Goods and Services" identified on the tender forms shall receive a bid adjustment in accordance with the NNI Policy and the adjustment percentages indicated on Appendix B-2 forms. "Inuit Goods and Services" means "Inuit Content" as defined in the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy definition appendix; the NNI Policy is attached as tender Appendix "J

Damages as described in contract General Condition GC 55 may apply if the Inuit Labour and/or Inuit Goods and Services proposed by the Contractor on the tender Appendix B-2 forms are not met. In addition, if the minimum prescribed levels of Inuit Labour identified on page 4 of this Appendix is not met, then for future tenders where there are similar prescribed minimum levels for Inuit Labour , the Contractor may be deemed "not responsible" (as defined in the Government Contract Regulations.)

2.0 DEFINITIONS

.1 "Inuit (singular Inuk)" means a person described in Article 1.1.1 of the Nunavut Land Claims Agreement (NLCA) and who has enrolled himself or herself on the Inuit Enrolment List under Article 35 of the NLCA.

.2 "Inuit firm" means an entity which complies with the legal requirements to carry on business in the Nunavut Settlement Area, and which is,

.1 a limited company with at least 51% of the company's voting shares beneficially owned by Inuit, or
.2 a cooperative controlled by Inuit, or
.3 an Inuk sole proprietorship or partnership; and
.4 is included on Nunavut Tunngavik Inc. (NTI)'s Inuit Firms Registry

.3 "Labour"

For the purpose of this contract and specifically Appendix K, "Labour" means the Labour (including Inuit labour) used on the job in any capacity and including, for example, tradespeople, administrative staff and professional staff whether in a head office or in a site office and attributable to this project. "Inuit Labour" refers to the status of employees and may be directly provided by the general contractor or indirectly through a sub contractor, and is not necessarily through an Inuit Firm.

.4 "Goods and Services"

For the purpose of this contract and specifically Appendix K, "Goods and Services" means the entire dollar value of the Work including Labour. For further clarification "Inuit Goods and Services" includes all labour of Inuit firms attributable to and paid from the Contract. "Inuit Goods and Services" are to have the same meaning as the term "Inuit Content" used in the General Conditions of the Construction Contract.

.5 "Inuit Content"
"Inuit Content" is defined as the dollar value of the goods and services required by the Contract supplied by any Inuit Firm or Inuit sole proprietorship and Inuit Labour. Inuit Content may include:

i. goods and services supplied by an Inuit Firm or Inuit supplier acting as the General Contractor. These are referred to as "own forces";
ii. goods and services supplied by an Inuit Firm or Inuit supplier so long as these goods and services are required for the completion of the Contract and are paid for by the Contract.
iii. Inuit labour by an Inuit Firm or a non-Inuit Firm.

3.0 REQUIREMENTS

.1 The Contractor shall maximize the value of Inuit Labour and Inuit Goods and Services by meeting or exceeding amounts identified in this appendix when bidding, and in the performance of the work shall meet or exceed the amounts tendered by the Contractor on Appendix B-2.

.2 The Contractors shall submit records on a monthly basis, or as specified, indicating the amount of Inuit Labour and Inuit Goods and Services used. No payment shall be due or payable to the Contractor if the Contractor fails to supply these reports to the Owner.

4.0 FAILURE TO ACHIEVE INUIT CONTENT REQUIREMENTS

In additional to the bonus or penalty prescribed by the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy for exceeding or not meeting the minimum prescribed Inuit Labour level set out on page 4 of this Appendix K; the following damages may apply for not meeting Inuit Labour and /or Inuit Goods and Services requirements:

.1 There is a requirement to provide no less than the levels of Inuit Labour and Inuit Goods and Services tendered by the Contractor on Appendix B-2 of the tender. Failure to meet this requirement by achieving the levels tendered may result in the Owner applying damages described in the contract General Condition GC 55.

.2 Additionally, if the contractor fails to meet the prescribed minimum Inuit Labour set out on page 4 of this Appendix K, then for future tenders where there are similar prescribed minimum levels for Inuit Labour the Owner may deem the Contractor to be "not responsible" (as defined in the Government Contract Regulations).

.3 The Owner may terminate this contract prior to Final Completion if the Contractor has not demonstrated compliance with the requirement to attain the prescribed minimum levels of Inuit Labour set out on page 4 of this Appendix K.

5.0 INDEMNIFICATION

.1 The Contractor shall indemnify the Owner against any claim brought by any Inuk or any other person because of any failure by the Contractor to achieve the prescribed levels of Inuit Labour prescribed by this contract.

6.0 WAIVER OF INUIT CONTENT REQUIREMENTS

.1 The prescribed level of Inuit Labour shall only be reduced when sufficient Inuit Labour is not available and the Contractor has requested and received prior approval by the Owner in writing to reduce the prescribed levels.

Inuit Labour

It is a fundamental term of this contract that the contractor shall maximize the value of Inuit labour used to perform the Work. Therefore the GN has set a minimum percent by dollar value for the use of Inuit labour. The Inuit labour content may be provided by the general contractor or any subcontractor and may include professional or administrative staff or skilled or unskilled trades people, and not necessarily through an Inuit Firm. The minimum may only be reduced where sufficient Inuit labour is not available and the approval of the Owner has been obtained in writing.

For the purposes of this contract the GN has prescribed that the following minimum percent of the total labour for this job by dollar value shall be provided by Inuit workers.	**30 %** **Prescribed** minimum level of Inuit labour as a percent of total labour by dollar value.

Substantiation

In order to substantiate the amount of Inuit Labour the general contractor shall be responsible for providing an amalgamated employment report that shall reflect the Inuit labour used by the general contractor and any other sub contractor or supplier. The general contractor shall submit this employment report with every Progress Claim. Receipt of an employment report shall be a condition precedent to the release of a progress payment, an interim payment and/or a final payment.

If requested, the general contractor shall also provide a completed "Employee Verification and Consent Form" for an Inuit worker.

Construction Contract

Project No: 4-002-450

Name of Project: PANGNIRTUNG SEWAGE TREATMENT PLANT

Project Location: PANGNIRTUNG, NUNAVUT

Contract Number: _____

ARTICLES OF AGREEMENT

These Articles of Agreement, effective on the _____ day of _____, 20 ____.

Between

_____

(herein the "Owner")

and

_____

(herein the "Contractor")

witness that in consideration for the mutual promises and obligations contained in the contract, the Owner and the Contractor covenant and agree as follows:

A1 CONTRACT DOCUMENTS

1.1 Subject to A1.4 and A1.5, the documents forming the contract between the Owner and the Contractor, referred to herein as the contract documents are all of those documents referred to on Appendix A of the Tender and;

1.1.1 any Addenda issued during the Tender period and identified in Clause 2 of the Tender Form,

1.1.2 any amendment or variation of the contract documents that is made in accordance with the General Conditions,

1.2 1.2.1 The Owner hereby designates _____ as the Owner's Representative for the Department of _____ of the Government of Nunavut.

1.2.3 The Contractor hereby designates _____ as the Contractor's Representative.

1.3 In the contract;

1.3.1 "Fixed Price Arrangement" means that part of the contract that prescribes a lump sum as payment for performance of the work to which it relates; and/or

1.3.2 "Unit Price Arrangement" means that part of the contract that prescribes the product of a price multiplied by a number of units of measurement of a class as payment for the performance of the work to which it relates.

1.4 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Unit Price arrangement are not applicable to any part of the work to which a Fixed Price Arrangement is applicable.

1.5 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Fixed Price Arrangement are not applicable to any part of the work to which a Unit Price Arrangement is applicable.

A2 DATE OF COMPLETION OF WORK AND DESCRIPTION OF WORK

2.1 The Contractor shall, between the effective date of the Agreement and the _____ day of _____, 20___, in a careful and workmanlike manner, diligently perform and complete the following work:

which work is more particularly described in the Plans and Specifications.

A3 CONTRACT AMOUNT

3.1 Subject to any increase, decrease, deduction, reduction, or set-off permitted under the terms of the contract, the Owner shall pay the Contractor at the times and in the manner that is set out or referred to in the Agreement;

3.1.1 the sum of $ _____ in consideration for the performance of the work or the part thereof that is subject to a Fixed Price Arrangement, and/or

3.1.2 a sum that is equal to the aggregate of the products of the number of units of measurement of each class of labour, plant and material that is set out in a Final Certificate of Measurement referred to in GC43.7 multiplied in each case by appropriate unit price that is set out in the Unit Price Table "Appendix D" in consideration for the performance of the work or the part thereof that is subject to a Unit Price Arrangement.

3.2 For the information and guidance of the Contractor and the person administering the contract on behalf of the Owner, but not so as to constitute a warranty, representation or undertaking of any nature by either party, it is estimated that the total amount payable by the Owner to the Contractor for the part of the work to which a Unit Price Arrangement is applicable will not exceed

$_____.

3.3 A3.1.1 is applicable only to a Fixed Price Arrangement

3.4 A3.1.2 and A3.2 are applicable only to a Unit Price Arrangement.

A4 UNIT PRICE TABLE

4.1 The Owner and the contractor agrees that Appendix "D" of the Tender is the Unit Price Table for the purposes of the Contract.

4.2 The Unit Price Table that is set out in A4.1 designates the part of the work to which a Unit Price Arrangement is applicable.

4.3 The part of the work that is not designated in the Unit Price Table referred to in A4.2 is the part of the work to which a Fixed Price Arrangement is applicable.

A5 FINANCIAL ADMINISTRATION ACT (NUNAVUT)

The attention of the Contractor is drawn to the following statutory provision. It is a condition of this Agreement that payment hereunder is subject to Section 46 of the Financial Administration Act (Nunavut) as amended or re-enacted in successor legislation during the term of this Contract. Section 46 currently provides as follows:

"It is a condition of every contract made by or on behalf of the Government requiring an expenditure that an expenditure pursuant to the contract will be incurred only if there is a sufficient uncommitted balance in the appropriated item for the fiscal year in which the expenditure is required under the Contract."

SIGNED, SEALED AND DELIVERED in the presence of:

Contractor: Contractor's Full Legal Business Name and Address:

_____ (Seal)

_____

_____

Facsimile No. _____

- _____
  Signature

  _____ _____
  Name Date

  _____
  Title

- _____ _____
  Signature Witness

  _____ _____
  Name Name

  _____ _____
  Title Title

Owner: Owner's Full Business Name and Address

_____

_____

Government of Nunavut _____

Facsimile No. (867) _____

- _____ _____
  Signature Date

  _____ _____
  Name Witness

  _____ _____
  Title Title

END OF ARTICLES OF AGREEMENT

TERMS OF PAYMENT

TP1 AMOUNT PAYABLE - GENERAL

1.1 Subject to any other provisions of the contract, the Owner shall pay the Contractor, at the times and in the manner hereinafter set out, the amount by which;

1.1.1 the aggregate of the amounts described in TP2 exceeds,

1.1.2 the aggregate of the amounts described in TP3, and

the Contractor shall accept that amount as payment in full satisfaction for everything furnished and done by him in respect of the work to which the payment relates.

TP2 AMOUNT PAYABLE TO THE CONTRACTOR

2.1 The amounts referred to in TP1.1.1 are the aggregate of;

2.1.1 the amounts referred to in the Articles of Agreement, and

2.1.2 the amounts, if any, that are payable to the Contractor pursuant to the General Conditions and the amounts, if any, that are a bonus for Inuit Labour achieved, as described in the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy for the contract work.

2.1.3 Under the terms of the new "Canada - Nunavut Reciprocal Tax Agreement" the Government of Nunavut will be paying the Goods and Services Tax (GST).

TP3 AMOUNTS PAYABLE TO THE OWNER

3.1 The amounts referred to in TP1.1.2 are the aggregate of the amounts, if any, that the Contractor is liable to pay the Owner pursuant to the contract, including any penalty assessed for Inuit Labour shortfalls, as described in the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy for the contract work.

3.2 When making any payment to the Contractor, the failure of the Owner to deduct an amount referred to in TP3.1, from an amount referred to in TP2 shall not constitute a waiver of the right to do so, or an admission of lack of entitlement to do so in any subsequent payment to the Contractor.

TP4 TIME OF PAYMENT

4.1 For the purposes of this Term of Payment, "payment period" means a period of 30 consecutive days or such other interval as is agreed between the Contractor and the Owner.

4.2 The Contractor shall, on the expiration of a payment period, deliver to the Owner in respect of that payment period a written progress claim that fully describes any part of the Work that has been completed, and any material that was delivered to the work site but not incorporated into the Work, during that payment period.

4.3 The Owner shall, not later than ten days after receipt by him of a progress claim referred to in TP4.2.

4.3.1 inspect the part of the work and the material described in the progress claim; and

4.3.2 issue a progress report, which may take the form of an endorsement on the progress claim, a copy of which will be given to the Contractor, that indicates the value of the part of the Work and the material described in the progress claim that, in his opinion,

4.3.2.1 is in accordance with the contract, and

4.3.2.2 was not included in any other progress report relating to the contract.

4.4 Subject to TP1, the Owner shall pay the Contractor in accordance with applicable statutes the amounts stipulated hereunder. Claims of Nunavut Contractors, as defined by the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy, will become due and payable 20 days after receipt by the Owner of the claim specified in 4.2. Claims from other Contractors will become due and payable 30 days after receipt by the Owner of the claim specified in 4.2.

4.4.1 an amount that is equal to 95% of the value that is indicated in that progress report if a labour and material payment bond has been furnished by the Contractor, or

4.4.2 an amount that is equal to 90% of the value that is indicated in that progress report if a labour and material payment bond has not been furnished by the Contractor.

4.5 Subject to TP1 and TP4.6, the Owner shall, not later than 20 days for Nunavut Contractors (as defined by the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy of the GN) or 30 days for other Contractors after the date of issue of a Substantial Certificate of Completion referred to in GC43.2, pay the Contractor the amount referred to in TP1 less the aggregate of;

4.5.1 the sum of all payments that were made pursuant to TP4.4,

4.5.2 an amount that is equal to the Owner's estimate of the cost to the Owner of rectifying defects described in the Substantial Certificate of Completion, and

4.5.3 an amount that is equal to the Owner's estimate of the cost to the Owner of completing the parts of the Work described in the Substantial Certificate of Completion other than the defects referred to in TP4.5.2

4.6 It is a condition precedent to the Owner's obligation under TP4.5 that:

4.6.1 the Contractor has made and delivered to the Owner a statutory declaration described in TP4.7 in respect of a Substantial Certificate of Completion referred to in GC43.2, and

4.6.2 the Contractor has complied with the various requirements to provide Inuit Local and Nunavut Employment and involvement reports as required in the Appendices to the Contractor's Tender Submission Form.

4.7 A statutory declaration referred to in TP4.6 and TP4.9 shall be submitted on the attached form, page 4 & 5. Substitutes will not be accepted.

4.8 Subject to TP1 and TP4.9, the Owner shall, not later than 20 days for Nunavut Contractors (as defined by the Nunavummi Nangminiqaqtunik Ikajuuti (N.N.I.) Policy of the GN) or 30 days for other Contractors after the date of issue of a Final Certificate of Completion referred to in GC43.1, pay the Contractor the amount referred to in TP1 less the aggregate of;

4.8.1 the sum of all payments that were made pursuant to TP4.4, and

4.8.2 the sum of all payments that were made pursuant to TP4.5.

4.9 It is a condition precedent to the Owner's obligation under TP4.8 that the Contractor has made and delivered a statutory declaration to the Owner as described in TP4.7 in respect of a Final Certificate of Completion referred to in GC43.1.

TP5 PROGRESS REPORT AND PAYMENT THEREUNDER NOT BINDING ON THE OWNER

5.1 Neither a progress report referred to in TP4.3 nor any payment made by the Owner pursuant to these Terms of Payment shall be construed as an admission by the Owner that the Work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

TP6 DELAY IN MAKING PAYMENT

6.1 Notwithstanding GC6 any delay by the Owner in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by the Owner.

6.2 When the Owner delays in making a payment that is due pursuant to TP4.4, TP4.5 and TP4.8, the Contractor shall be entitled to receive interest on the amount that is overdue in accordance with the Government of Nunavut's Financial Administration Manual Section 803-4.

6.3 The Contractor shall not be entitled to receive interest on any other amount that is unpaid including, without limitation, an amount that is calculated in accordance with GC49.

TP7 RIGHT OF SET-OFF

7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, the Owner may set-off any amount payable to the Owner by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract or under any current contract.

7.2 For the purposes of this Term of Payment, "current contract", means a contract between the Owner and the Contractor;

7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or;

7.2.2 in respect of which the Owner has, since the date on which the Articles of Agreement were made, exercised any right to take the work that is subject of the contract out of the Contractor's hands.

TP8 PAYMENT IN EVENT OF TERMINATION

8.1 If the contract is terminated pursuant to GC40, the Owner shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

Certificate of Completion - STATUTORY DECLARATION

1st Page

THE MATTER OF a contract bearing

_____

between the Government of Nunavut and

_____
(Insert full name of contractor)

herein the Contractor,

for _____
(briefly describe the work to be performed)

dated the _____ day of _____ , 20____.

and

IN THE MATTER OF the Certificate of Completion relating thereto

TO WIT:

I, _____ of _____
(print or type full name of declarant) (declarant's city of residence)

DO SOLEMNLY DECLARE:

(1) That I am _____
(print or type declarant's position or title with the Contractor or state that the declarant is the Contractor)

And as such have a personal knowledge of the said contract and of the facts and matters stated herein.

(2) That all assessments and levies under The Unemployment Insurance Act, The Workers' Compensation Act or other social or labour legislation in respect of the said contract have been fully paid:

(3) That all subcontractors, labourers and suppliers of materials and equipment whatsoever who have entered into agreements to supply goods or services which have been incorporated into the construction of this project have been fully paid except for contractual holdbacks and the further amount(s), if any, which is (are) listed below which is (are) being withheld from the subcontractor(s) listed herein, due to legitimate dispute(s) arising out of the performance, or lack of performance, of the work by the listed subcontractor(s).

Subcontractor(s)	Amount(s) in Dispute and Being Withheld
_____	_____
_____	_____
_____	_____

Certificate of Completion - STATUTORY DECLARATION

2nd Page

and the following amounts, if any, which are being withheld pending payment to the Contractor by the Owner.

Subcontractor(s)	Amount(s) in Dispute and Being Withheld

And I make this SOLEMN DECLARATION conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the LAWS OF CANADA and NUNAVUT.

DECLARED before me at _____

This _____ day of _____

_____
(Signature of Declarant)

_____
(signature of person before whom declaration is made)

_____
(print name of person before whom declaration is made)

A Notary Public, Commissioner, etc. _____

(please state clearly authority for receiving solemn declarations - notaries to affix notary seal)

NOTE 1. Where the Contractor is a corporation or a partnership, declarant's position in the corporation or partnership, and the corporation or partnership name should be clearly shown in No. 1.

NOTE 2. Where the Contractor is an individual he must make the declaration himself. Where the Contractor is a partnership the declaration must be made by one of the partners. Where the Contractor is an incorporated company, the declaration must be made by the President, Vice-President, Secretary Treasurer or a Director. If any other person makes the declaration, two copies of the by-law issued under the corporation seal, authorizing the individual to execute documents must be submitted with the first declaration of each contract.

If this declaration is not complete in every detail, it will be returned for completion and payment will be delayed.

The following section of the Criminal Code of Canada is hereby brought to the attention of the Declarant:

122. Everyone who, not being a witness in a judicial proceeding but being permitted, authorized or required by law to make a statement by affidavit, by solemn declaration or orally under oath, makes in such statement, before a person who is authorized by law to permit it to be made before him, an assertion with respect to a matter of fact, opinion, belief or knowledge, knowing that the assertion is false, is guilty of an offense and is liable to imprisonment for fourteen years.

122.1 (1) Everyone who, not being specially permitted, authorized or required by law to make a statement by affidavit, by solemn declaration or orally under oath, makes in such a statement, before a person who is authorized by law to permit it to be made before him, an assertion with respect to a matter of fact, opinion, belief or knowledge, knowing that the assertion is false, is guilty of an offense punishable on summary conviction."

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GENERAL CONDITIONS

GC1 INTERPRETATION

1.1 In the contract

1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein.

1.1.2 "contract" means the contract documents referred to in the Articles of Agreement.

1.1.3 "contract security" means any security given by the Contractor to the Owner in accordance with the contract.

1.1.4 "Engineer" means the officer or employee of the Owner who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract.

1.1.5 "material" includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work.

1.1.6 "person" includes, unless the context otherwise requires, a partnership, proprietor-ship, firm, joint venture, consortium and a corporation.

1.1.7 "plant" includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract.

1.1.8 "subcontractor" means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work.

1.1.9 "substantial performance" as defined in the lien legislation applicable to the Place of Work. If such legislation is not in force, is not applicable or does not contain such definition, substantial performance shall have been reached when Work is ready for use or is being used for the purpose intended and is so certified by the Engineer.

1.1.10 "superintendent" means the employee of the Contractor who is designated by the Contractor to act pursuant to GC18.

1.1.11 "work" includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The division into sections, the table of contents, and the headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.

1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between:

1.4.1 the Plans and Specifications, the Specifications govern;

1.4.2 the Plans, the Plans drawn with the largest scale govern, and

1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

1.5 Any reference to a statutory provision shall include any subordinate legislation made and from time-to-time amended, extended or re-enacted.

1.6 This Agreement shall be governed by and construed in accordance with the laws of Nunavut and the laws of Canada as applicable therein.

1.7 Unless otherwise indicated, all dollar amounts referred to in the Agreement are in lawful money of Canada

1.8 In any provision of this Agreement is determined to be invalid or unenforceable in whole or in part, such invalidity or unenforceability shall attach only to such provision and everything else in this Agreement shall continue in full force and effect. In the event any provision of this Agreement, as amended from time to time, shall be deemed invalid or void, in whole or in part, by any court of competent jurisdiction, the remaining terms and provisions of this Agreement shall remain in full force and effect.

1.9 Failure by either party to exercise any of its rights, powers or remedies hereunder or its delay to do so shall not constitute a waiver of those rights, powers or remedies. The single or partial exercise of a right, power or remedy shall not prevent its subsequent exercise or the exercise of any other right, power or remedy.

1.10 The Contractor shall be required to comply, and shall require its subcontractors to comply, with all applicable laws, orders, rules and regulations; and, without limiting the generality of the foregoing, the Contractor shall at its sole expense comply with all unemployment insurance, Worker's Compensation, income tax, payroll tax, Canada Pension Plan, occupational health and safety and environmental protection legislation.

GC2 SUCCESSORS AND ASSIGNS

2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

GC3 ASSIGNMENT OF CONTRACT

3.1 The contract may not be assigned by the Contractor, either in whole or in part without the written consent of the Owner.

GC4 SUBCONTRACTING BY CONTRACTOR

4.1 Subject to this General Condition, the Contractor may subcontract any part of the work so long as such subcontracting is consistent with the information provided on Appendix B-1 and B-2 of the Tender.

4.2 The Contractor shall notify the Engineer of his intention to subcontract.

4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.

4.4 The Engineer may, within six days of receipt by him of a notification referred to in GC4.2, object to the intended subcontracting.

4.5 If the Engineer objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.

4.6 The Contractor shall not, without the written consent of the Owner change a subcontractor who has been engaged by him in accordance with this General Condition and the tender form, and if any changes are made without consent, the contract may be terminated at the option of the Owner.

4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of this contract that are of general application.

4.8 Neither a subcontracting nor the Engineer's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon the Owner

GC5 AMENDMENTS

5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

GC6 NO IMPLIED OBLIGATIONS

6.1 No implied terms or obligations of any kind by or on behalf of the Owner shall arise from anything in the contract and the express covenants and agreements therein contained and made by the Owner are the only covenants and agreements upon which any rights against the Owner are to be founded.

6.2 The contact supersedes all communications, negotiations and agreements, either written or oral, relating to the work that was made prior to the date of the contract.

GC7 TIME OF ESSENCE

7.1 Time is of the essence of the contract.

GC8 INDEMNIFICATION BY CONTRACTOR

8.1 The Contractor shall indemnify and save the Owner harmless from and against all claims, demands, losses, damages, actions, suits or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, and subcontractors in performing the work including an infringement or an alleged infringement of patent of invention or any kind of intellectual property.

8.2 For the purposes of GC8.1, "activities" includes but is not limited to any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

GC9 INDEMNIFICATION BY THE OWNER

9.1 The Owner shall, subject to any law that affects the Owner's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to

9.1.1 lack of or a defect in the Owner's title to the work site whether real or alleged; or

9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by the Owner to the Contractor.

GC10 NOTICES TO CONTRACTOR

10.1 Notices for the purposes of GC37.1.1, GC39 and GC40 shall be in writing and shall be given

10.1.1 by delivering the notice to the Contractor in person or, if the Contractor is a partnership, firm, joint venture consortium or corporation, to a senior administrative or executive officer thereof, or

10.1.2 by mailing the notice to the Contractor at his address set out in the Articles of Agreement.

10.2 A notice referred to in GC10.1 shall be deemed to have been received by the Contractor

10.2.1 if it was delivered pursuant to GC10.1.1, on the day that it was delivered, and

10.2.2 if it was sent by mail pursuant to GC10.1.2, on the earlier of the day it was received by the Contractor and the sixth day after it was mailed.

10.3 Any notice, consent, order, direction, decision, or other communication, other than a notice referred to in GC10.1, that may be given to the Contractor pursuant to the contract may be given in any manner, but it shall be deemed to have been received by the contractor, if it is in writing.

10.3.1 on the day that it was delivered to the superintendent, or

10.3.2 on the sixth day after it was mailed to the Contractor at his address set out in the Articles of Agreement.

10.4 Where the postal service is disrupted by a strike, a notice, consent, order, direction, decision or other communication may be given to the Contractor by facsimile and shall be deemed to have been received by the Contractor twenty-four hours after it was transmitted

GC11 MATERIAL, PLANT AND REAL PROPERTY SUPPLIED BY THE OWNER

11.1 Subject to GC11.2, the Contractor is liable to the Owner for any loss or damage to material, plant or real property that is supplied or placed in the care, custody and control of the contractor by the Owner for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.

11.2 The Contractor is not liable to the Owner for any loss or damage to material, plant or real property referred to in GC11.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.

11.3 The Contractor shall not use any material, plant or real property referred to in GC11.1 except for the purpose of performing this contract.

11.4 When the Contractor fails to make good any loss or damage for which he is liable under GC11.1 within a reasonable time after being required to so by the Engineer, the Engineer may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to the Owner for the cost thereof and shall, on demand, pay to the Owner an amount equal to that cost.

11.5 The Contractor shall keep such records of all material, plant and real property referred to in GC11.1 as the Engineer from time to time requires and shall satisfy the Engineer, when requested, that such material, plant and real property are at the place and in the condition in which they ought to be.

GC12 MATERIAL, PLANT AND REAL PROPERTY BECOME THE PROPERTY OF THE OWNER

12.1 All material and plant and the interest of the Contractor in all real property, licenses, powers and privileges acquired, used or provided by him for the contract shall, from the time of their acquisition, use or provision, be the property of the Owner for the purposes of the work and they shall continue to be the property of the Owner

12.1.1 in the case of material, until the Engineer indicates that he is satisfied that it will not be required for the work; and

12.1.2 in the case of plant, real property, licenses, powers and privileges, until the Engineer indicates that he is satisfied that the interest vested in the Owner therein is no longer required for the purposes of the work.

12.2 Material or plant that is the property of the Owner by virtue of GC12.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Engineer.

12.3 The Owner is not liable for loss of or damage from any cause to the material or plant referred to in GC12.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of the Owner

GC13 MUNICIPAL PERMITS

13.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than the Owner

13.2 Within 10 days of making a tender pursuant to GC13.1, the Contractor shall notify the Engineer of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.

13.3 If the municipal authority does not accept the amount tendered pursuant to GC13.1, the Contractor shall pay that amount to the Owner within 6 days after the time stipulated in GC13.2.

13.4 For the purposes of GC13.1, to GC13.3, "municipal authority" means any authority that would have jurisdiction respecting permission to perform the work if the owner were not the Owner.

GC14 PERFORMANCE OF WORK UNDER DIRECTION OF ENGINEER

14.1 The Contractor shall

14.1.1 permit the Engineer to have access to the work and its site at all times during the performance of the contract:

4.1.2 furnish the Engineer with such information respecting the performance of the contract as he may require; and

14.1.3 give the Engineer every possible assistance to enable the Engineer to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Engineer under the contract.

GC15 COOPERATION WITH OTHER CONTRACTORS

15.1 Where, in the opinion of the Engineer, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Engineer, allow them access and cooperate with them in the carrying out of their duties and obligations.

15.2 The Owner shall pay the Contractor the cost calculated in accordance with GC46 to GC49, of the extra labour, plant and material that was necessarily incurred if:

15.2.1.1.1 the sending onto the work or its site of other contractors or workers pursuant to GC15.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract;

and

15.2.2 the Contractor incurs, in the opinion of the Engineer, extra expense in complying with GC15.1;

and

15.2.3 the Contractor has given the Engineer written notice of his claim for the extra expense referred to in GC15.2.2 within 10 days of the date that the other contractors or workers were sent onto the work or its site.

GC16 EXAMINATION OF WORK

16.1 If, at any time after the commencement of the work but prior to the expiry of the warranty period, the Engineer has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Engineer may have that work examined by an expert of his choice.

16.2 If, as a result of an examination of the work referred to in GC16.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of the Owner's rights and remedies under the contract either at law or in equity, the

Contractor shall pay the Owner, on demand, all reasonable costs and expenses that were incurred by the Owner in having that examination performed.

GC17 CLEARING OF SITE

17.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Engineer.

17.2 Before the issue of a Certificate of Substantial Completion referred to in GC43.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy or use by the Owner's servants, unless otherwise stipulated in the contract. The Contractor shall, as directed by the owner, take down all signs erected during construction.

17.3 Before the issue of a final certificate referred to in GC43.1, the Contractor shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

17.4 The Contractor's obligations described in GC17.1 to GC17.3 do not extend to waste material and other debris caused by the Owner's servants or contractors and workers referred to in GC15.1.

GC18 CONTRACTOR'S SUPERINTENDENT

18.1 The Contractor shall, forthwith upon the award of the contract, designate a Superintendent.

18.2 The Contractor shall forthwith notify the Engineer of the name, address and telephone number of a superintendent designated pursuant to GC18.1.

18.3 A superintendent designated pursuant to GC18.1 shall be in full charge of the site of the work and the operations of the Contractor, his servants, agents, and subcontractors in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.

18.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.

18.5 The Contractor shall, upon the request of the Engineer, remove any superintendent who, in the opinion of the Engineer, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Engineer.

18.6 Subject to GC18.5, the Contractor shall not substitute a superintendent without the written consent of the Engineer.

18.7 A breach by the Contractor of GC18.6 entitles the Engineer to refuse to issue any certificate referred to in GC43 until the superintendent has returned to the work site or another superintendent who is acceptable to the Engineer has been substituted.

GC19 NATIONAL SECURITY

19.1 If the Owner is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor

19.1.1. to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and

19.1.2 to remove any person from the work and its site if, in the opinion of the Owner, that person may be a risk to the national security.

19.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC18 to GC20.

19.3 The Contractor shall comply with an order of the Owner under GC19.1.

GC20 UNSUITABLE WORKERS

20.1 The Contractor shall, upon the request of the Engineer, remove any person employed by him for purposes of the contract who, in the opinion of the Engineer, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

GC21 INCREASED OR DECREASED COSTS

21.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or the wage rates set out in or prescribed pursuant to the Labour Conditions.

21.2 Notwithstanding GC21.1, and GC34, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC21.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act or the Customs Tariff

21.2.1 occurs after the date of the submission by the Contractor of his tender for the contract.

21.2.2 applies to material, and

21.2.3 affects the cost to the Contractor of that material.

21.3 If a change referred to in GC21.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC50 to be the increase or decrease in the cost incurred that is directly attributable to that change.

21.4 For the purpose of GC21.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Owner of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

GC22 LABOUR AND MATERIAL

22.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and the expeditious carrying out of the work.

GC23 PROTECTION OF WORK AND DOCUMENTS

23.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, information, material, plant and real property, whether or not they are supplied by the Owner to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Owner, except as may be essential for the performance of the work.

23.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Engineer to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.

23.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Owner to inspect or to take security measures in respect of the work and its site.

23.4 The Engineer may direct the Contractor to do such things and to perform such additional work as the Engineer considers reasonable and necessary to ensure compliance with or to remedy a breach of GC23.1 to GC23.3.

GC24 PUBLIC CEREMONIES AND SIGNS

24.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Owner.

24.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Engineer.

GC25 PRECAUTIONS AGAINST DAMAGE, INFRINGEMENT OF RIGHTS, FIRE AND OTHER HAZARDS

25.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that:

25.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reason of the Contractor's activities in performing the contract.

25.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;

25.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Engineer, any fire is promptly extinguished.

25.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;

25.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;

25.1.6 adequate sanitation measures are taken in respect of the work and its site; and

25.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Engineer are protected and are not removed, defaced, altered or destroyed.

Without limiting any of the foregoing, the Contractor shall take all actions required or necessary to ensure compliance by all persons employed in the performance of the work or at the site of the work, including the employees of the Contractor and sub-contractors and their employees, with the *Consolidation of Safety Act,* R.S.N.W.T. 1988, c.S-1 and any regulations thereunder.

25.2 The Engineer may direct the Contractor to do such things and to perform such additional work as the Engineer considers reasonable and necessary to ensure compliance with or to remedy a breach of GC25.1.

25.3 The Contractor shall, at his own expense, comply with a direction of the Engineer made under GC25.2.

GC26 INSURANCE

26.1 The Contractor shall, at his own expense, maintain insurance contracts in respect of the work

26.1.1 with insurance companies approved by the Owner, companies must comply with the Insurance Act for Nunavut, and

26.1.2 that are in a form, of the nature, in the amounts, for the periods and containing the terms and conditions, if any, specified in GC58, GC59, GC60, GC61 and GC62.

GC27 INSURANCE PROCEEDS

27.1 If the work or any part thereof is lost, damaged or destroyed and monies are paid to the Owner in respect of that loss, damage or destruction under an insurance contract maintained by the Contractor pursuant to GC26, the monies shall be held by the Owner for the purposes of the contract.

27.2 The Owner may elect to retain the monies referred to in GC27.1 and in that event the monies belong to the Owner absolutely.

27.3 If an election is made pursuant to GC27.2, the Owner may cause an audit to be made of the accounts of the Contractor and of the Owner in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

27.3.1 the aggregate of the amount of the loss or damage suffered or sustained by the Owner, including any costs incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to the Owner under the contract, minus any monies retained pursuant to GC27.2 and

27.3.2 the aggregate of the amounts payable by the Owner to the Contractor pursuant to the contract up to the date of the loss or damage.

27.4 A difference that is established pursuant to GC27.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the creditor.

27.5 When payment of a deficiency has been made pursuant to GC27.4, all rights and obligations of the Owner and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC27.3, be deemed to have been expended and discharged.

27.6 If an election is not made pursuant to GC27.2, the Contractor shall, subject to GC27.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.

27.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC27.6, the Owner shall pay him out of the monies referred to in GC27.1 so far as they will thereunto extend.

27.8 Subject to GC27.7, payment to the Owner pursuant to GC27.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

GC28 CONTRACT SECURITY

28.1 The Contractor shall obtain and deliver contract security to the Engineer in accordance with the provisions of GC56 and GC57.

28.2 If the whole or a part of the contract security referred to in GC28.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC42 and GC44.

28.3 If a part of the contract security referred to in GC28.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

GC29 CHANGES IN THE WORK

29.1 Subject to GC5, the Engineer may, at any time before he issues his Final Certificate of Completion:

29.1.1 order work or material in addition to that provided for in the Plans and Specifications; and

29.1.2 dispense with or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or in any order made pursuant to GC29.1.1, if that additional work or material

dispensation, or change is, in his opinion, consistent with the general intent of the original contract.

29.2 The Contractor shall perform the work in accordance with such order, dispensations and changes that are made by the Engineer pursuant to GC29.1 from time to time as if they had appeared in and been part of the Plans and Specifications.

29.3 The Engineer shall determine whether or not anything done or omitted by the Contractor pursuant to an order, dispensation or change referred to in GC29.1 increased or decreased the cost of the work to the Contractor.

29.4 If the Engineer determines pursuant to GC29.3 that the cost of the work to the Contractor has been increased, the Owner shall pay the Contractor the increased cost of the labour, plant and material that he necessarily incurred calculated in accordance with GC46 to GC49.

29.5 If the Engineer determines pursuant to GC29.3 that the cost of the work to the Contractor has been decreased, the Owner may reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost of the labour, plant and material that was incurred calculated in accordance with GC46 to GC49.

29.6 An order, dispensation or change referred to in GC29.1 shall be in writing, signed by the Engineer and given to the Contractor in accordance with GC10.

GC30 INTERPRETATION OF CONTRACT BY ENGINEER

30.1 If, at any time before the Engineer has issued a Final Certificate of Completion referred to in GC43.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about

30.1.1 the meaning of anything in the Plans and Specifications,

30.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their wording or intention,

30.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,

30.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,

30.1.5 what quantity of any kind of work has been completed by the Contractor, or

30.1.6 the timing and scheduling of the various phases of the performance of the work,

the question shall be decided by the Engineer whose decision shall be final and conclusive in respect of the work.

30.2 The Contractor shall perform the work in accordance with any decisions of the Engineer that are made under GC30.1 and in accordance with any consequential directions given by the Engineer.

GC31 WARRANTY AND RECTIFICATION OF DEFECTS IN WORK

31.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense, rectify and make good any defect or fault that appears in the work or comes to the attention of the Owner within 12 months from the date of the Substantial Completion referred to in GC43.2.

31.2 The Engineer may direct the Contractor to rectify and make good any defect or fault referred to in GC31.1 or covered by any other expressed or implied warranty or guarantee.

31.3 A direction referred to in GC31.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC10.3.

31.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC31.2 within the time stipulated therein.

GC32 NON-COMPLIANCE BY CONTRACTOR

32.1 If the Contractor fails to comply with any decision or direction given by the Engineer pursuant to GC17, GC23, GC25, GC30 or GC31, the Engineer may employ such methods as he deems advisable to do that which the Contractor failed to do.

32.2 The Contractor shall, on demand, pay the Owner an amount that is equal to the aggregate of all costs, expenses and damage incurred or sustained by the Owner by reason of the Contractor's failure to comply with any decision or direction referred to in GC32.1, including the cost of any methods employed by the Engineer pursuant to GC32.1.

GC33 PROTESTING ENGINEER'S DECISIONS

33.1 The Contractor may, within ten (10) days after the communication to him of any decision or direction referred to in GC32.1, protest that decision or direction.

33.2 A protest referred to in GC33.1 shall be in writing, contain full reasons for the protest, be signed by the Contractor and be given to the Owner by delivery to the Engineer.

33.3 If the Contractor gives a protest pursuant to GC33.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction or prevent the Contractor from taking whatever lawful action he considers appropriate in the circumstances.

33.4 The giving of a protest by the Contractor pursuant to GC33.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.

33.5 Subject to GC33.6, the Contractor shall take any action referred to in GC33.3 within three months after the date that a Final Certificate of Completion is issued under GC43.1 and not afterwards.

33.6 The Contractor shall take any action referred to in GC33.3, resulting from a direction under GC31 within three months after the expiry of a warranty or guarantee period and not afterwards.

33.7 Subject to GC33.8, if the Owner determines that the Contractor's protest is justified, the Owner shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.

33.8 Costs referred to in GC33.7 shall be calculated in accordance with GC47 to GC49.

GC34 CHANGES IN SOIL CONDITIONS AND NEGLECT OR DELAY BY THE OWNER

34.1 Subject to GC34.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by the Owner to the Contractor for any extra expense or any loss ore damage incurred or sustained by the Contractor.

34.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to

34.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by

the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or

34.2.2 any neglect or delay that occurs after the date of the contract on the part of the Owner in providing any information or in doing any act that the contract either expressly requires the Owner to do or that would ordinarily be done by an owner in accordance with the usage of the trade.

He shall, within ten days of the date that an event described in GC34.2.1 or GC34.2.2 occurred, give the Engineer written notice of the event and of his intention to claim for that extra expense or that loss or damage.

34.3 When the Contractor has given a notice referred to in GC34.2, he shall give the Engineer a written claim for extra expense or loss or damage within 30 days of the date that a Final Certificate of Completion referred to in GC43.1 is issued and not afterwards.

34.4 A written claim referred to in GC34.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Engineer to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Engineer requires from time to time.

34.5 If the Engineer determines that a claim referred to in GC34.3 is justified, the Owner may make an extra payment to the Contractor in an amount that is calculated in accordance with GC46 to GC49.

34.6 If, in the opinion of the Engineer, an occurrence described in GC34.2.1 results in a saving of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to the GC34.7, be reduced by an amount that is equal to the saving.

34.7 The amount of the saving referred to GC34.6 shall be determined in accordance with GC46 to GC49.

34.8 If the Contractor fails to give a notice referred to in GC34.2 and a claim referred to in GC34.3 within the times stipulated, an extra payment should not be made to him in respect of the occurrence.

GC35 EXTENSION OF TIME

35.1 Subject to GC35.2, the Engineer may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date, if in his opinion, causes beyond the control of the Contractor have delayed its completion.

35.2 An application referred to in GC35.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

GC36 ASSESSMENTS AND DAMAGES FOR LATE COMPLETION

36.1 For the purposes of this General Condition

36.1.1 the work shall be deemed to be completed on the date that a Substantial Certificate of Completion referred to in GC43.2 is issued, and

36.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC35.1, and any other day on which, in the opinion of the Engineer, completion of the work was delayed for reasons beyond the control of the Contractor.

36.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay the Owner an amount equal to the aggregate of

36.2.1 all salaries, wages, and travelling expenses incurred by the Owner in respect of persons overseeing the performance of the work during the period of delay,

36.2.2 the cost incurred by the Owner as a result of the liability to use the completed work for the period of delay; and

36.2.3 all other expenses and damages incurred or sustained by the Owner during the period of delay as a result of the work not being completed by the day fixed for its completion.

36.3 The Owner may waive its right to the whole or any part of the amount payable by the Contractor pursuant to GC36.2 if, in the opinion of the Owner, it is in the public interest to do so.

GC37 TAKING THE WORK OUT OF THE CONTRACTOR'S HANDS

37.1 The Owner may, at its sole discretion, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor

37.1.1 has not, within six days after receiving notice given by the Owner or the Engineer in accordance with GC10.1, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Engineer;

37.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;

37.1.3 has become insolvent;

37.1.4 has committed an act of bankruptcy;

37.1.5 has abandoned the work;

37.1.6 has made an assignment of the contract without the consent required by GC3.1; or

37.1.7 has otherwise failed to observe or perform any of the provisions of the contract.

37.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC37.1;

37.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC37.4, extinguished, and

37.2.2 the Contractor is liable to pay the Owner, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by the Owner in respect of the Contractor's failure to complete the work.

37.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC37.1 is completed by the Owner, the Engineer shall determine the amount, if any, of a holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating the Owner for any other loss or damage incurred or sustained by reason of the Contractor's default.

37.4 The Owner may pay the Contractor the amount determined not to be required pursuant to GC37.3.

GC38 EFFECT OF TAKING THE WORK OUT OF THE CONTRACTOR'S HANDS

38.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC37 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.

38.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC37, all plant and material and the interest of the Contractor in all real property, licenses, powers and privileges acquired,

used or provided by the Contractor under the contract shall continue to be the property of the Owner without compensation.

38.3 When the Engineer certifies that any plant, material, or any interest of the Contractor referred to in GC38.2 is no longer required for the purposes of the work, or that it is not in the interests of the Owner to retain that plant, material, or interest, it shall revert to the Contractor.

GC39 SUSPENSION OF WORK

39.1 The Owner may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension to the Contractor in accordance with GC10.

39.2 When a notice referred to in GC39.1 is received by the Contractor in accordance with GC10 he shall suspend all operations in respect of the work except those that, in the opinion of the Engineer, are necessary for the care and preservation of the work, plant and material.

39.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Engineer.

39.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC47 to GC49, of any labour, plant and material necessarily incurred by him as a result of the suspension.

39.5 If, upon the expiration of a period of suspension of more than 30 days, the Owner and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Owner and the Contractor.

39.6 If, upon the expiration of a period of suspension of more than 30 days, the Owner and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC40.

GC40 TERMINATION OF CONTRACT

40.1 The Owner may terminate the contract at any time by giving a notice of termination to the Contractor in accordance with GC10.1.

40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC10, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.

40.3 If the contract is terminated pursuant to GC40.1, the Owner shall pay the Contractor, subject to GC40.4, an amount equal to

40.3.1 the cost to the Contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated, in the contract, or

40.3.2 the lesser **of**

40.3.2.1 an amount, calculated in accordance with the Terms of Payment, that would have been payable to the Contractor had he completed the work, and

40.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC48 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract.

less the aggregate of all amounts that were paid to the Contractor by the Owner and all amounts that are due to the Owner from the Contractor pursuant to the contract.

40.4 If the Owner and the Contractor are unable to agree about an amount referred to in GC40.3 that amount shall be determined by the method referred to in GC49.

GC41 CLAIMS AGAINST AND OBLIGATIONS OF THE CONTRACTOR OR SUBCONTRACTOR

41.1 The Owner may, in order to discharge lawful obligations of and satisfy lawful claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or subcontractor.

41.2 A payment made pursuant to GC41.1, is to the extent of the payment, a discharge of the Owner's liability to the Contractor under the contract and may be deducted from an amount payable to the Contractor under the contract.

41.3 To the extent that the circumstances of the work being performed for the Owner permit, the Contractor shall comply with all laws in force in Nunavut relating to payment periods, mandatory holdbacks, and creation and enforcement of mechanics' liens.

41.4 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires the Owner to pay the Contractor.

41.5 The Contractor shall, whenever requested to do so by the Engineer, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC41.4.

41.6 GC41.1 shall only apply to claims and obligations that have been received by the Engineer in writing before payment to the Contractor pursuant to TP4.8 and within 120 days after a claimant

41.6.1 should have been paid in full under his contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or

41.6.2 performed the last of the service, work or labour, or furnished the last of the material pursuant to his contract with the Contractor or subcontractor, where the claim is not for money referred to in GC41.6.1.

41.7 No interest will be paid to the Contractor on any monies withheld pursuant to GC41 due to a Contractor or subcontractor's claim for non-payment.

GC42 SECURITY DEPOSIT - FORFEITURE OR RETURN

42.1 The Owner may convert the security deposit, if any, to its own use, if

42.1.1 the work is taken out of the Contractor's hands pursuant to GC37;

42.1.2 the contract is terminated pursuant to GC40; or

42.1.3 the Contractor is in breach of or in default under the contract.

42.2 If the Owner converts the contract security pursuant to GC42.1, the amount realized shall be deemed to be an amount due from the Owner to the Contractor under the contract.

42.3 Any balance of an amount referred to in GC42.2 that remains after payment of all losses, damage and claims of the Owner and other shall be paid by the Owner to the Contractor, if in the opinion of the Engineer, it is not required for the purposes of the contract.

GC43 ENGINEER'S CERTIFICATES

43.1 On the date that

43.1.1 the work has been completed, and

43.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Engineer, he shall issue a Certificate of Final Completion to the Contractor.

43.2 If the Engineer is satisfied that the work is sufficiently complete to be acceptable for use by the Owner, he may, at any time before he issues a certificate referred to in GC43.1, issue a Certificate of Substantial Completion to the Contractor.

43.3 A Certificate of Substantial Completion referred to in GC43.2 shall describe the parts of the work not completed to the satisfaction of the Engineer and all things that must be done by the Contractor before a certificate referred to in GC43.1 will be issued.

43.4 The Engineer may, in addition to the parts of the work described in a Certificate of Substantial Completion referred to in GC43.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the completion of the work.

43.5 If the contract or a part thereof is subject to a Unit Price Arrangement, the Engineer shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

43.6 The Contractor shall assist and co-operate with the Engineer in the performance of his duties referred to in GC43.5 and shall be entitled to inspect any record made by the Engineer pursuant to GC43.5.

43.7 After the Engineer has issued a Certificate of Final Completion referred to in GC43.1, he shall, if GC43.5 applies, issue a Certificate of Final Measurement.

43.8 A Certificate of Final Measurement referred to in GC43.7 shall

43.8.1 contain the aggregate of all measurements of quantities referred to in GC43.5, and

43.8.2 be binding upon and conclusive between the Owner and the Contractor as to the quantities referred to therein.

GC44 RETURN OF SECURITY DEPOSIT

44.1 After a Certificate of Substantial Completion referred to in GC43.2 has been issued, the Owner shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Engineer, is not required for the purposes of the contract.

44.2 After a Certificate of Final Completion referred to in GC43.1 has been issued, the Owner shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.

44.3 Interest shall not be paid on security deposits.

GC45 CLARIFICATION OF TERMS IN GC46 TO GC49

45.1 For the purposes of GC46 to GC49.

45.1.1 "Unit Price Table" means the table set out in the Tender, and

45.1.2 "plant" does not include tools customarily provided by a tradesman in practising his trade.

GC46 ADDITIONS OR AMENDMENTS TO UNIT PRICE TABLE

46.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Engineer and the Contractor may, by an agreement in writing

46.1.1 add classes of labour, plant or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in a Final Certificate of Measurement referred to in GC43.7 in not included in any class of labour, plant or material set out in the Unit Price Table; or

46.1.2 subject to GC46.2, amend a price per unit set out in the Unit Price Table for any class of labour, plant or material included therein if an estimated quantity is set out therein for that class of labour, plant or material and a Final Certificate of Measurement referred to in GC43.7 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is

46.1.2.1 less than 85% of that estimated quantity; or

46.1.2.2 in excess of 115% of that estimated quantity.

46.2 An amendment that is made necessary by GC46.1.2.2 shall apply only to the quantities that are in excess of 115%.

46.3 If the Engineer and the Contractor do not agree as contemplated in GC46.1, the Engineer shall determine the class and the unit of measurement of the labour, plant or material and the price per unit therefore shall be determined in accordance with GC49.

GC47 DETERMINATION OF COST - UNIT PRICE TABLE

47.1 Whenever, for the purposes of the contract it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in the Unit Price Table by the price of that unit set out in the Unit Price Table.

GC48 DETERMINATION OF COST - NEGOTIATION

48.1 If the method described in GC47 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of the labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Engineer.

48.2 For the purpose of GC48.1, the Contractor, when requested by the Engineer, shall submit a detailed statement of the cost to him of the labour, plant and material referred to in GC48.1 to the Engineer.

GC49 DETERMINATION OF COST - FAILING NEGOTIATION

49.1 If the parties or the methods described in GC46, GC47 or GC48 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of

49.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant or material that falls within one of the classes of expenditure described in GC49.2 that are directly attributable to the performance of the contract, and

49.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration costs, financing and interest charges, and every other cost, charge and expense but not including those referred to in GC49.1.1 or of a class referred to in GC49.2, in an amount that is equal to:

(a) 10% of the sum of the expenses referred to in GC49.2.1;

(b) 20% of the sum of the expenses referred to in GC49.2.2 through GC49.2.8

49.2 For purposes of GC49.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,

49.2.1 payments to subcontractors;

49.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Engineer;

49.2.3 assessments payable under any statutory authority relating to worker's compensation, unemployment insurance, pension plan or holidays with pay;

49.2.4 rent that is paid for plant or an allowance for depreciation of plant owned by the Contractor that is necessary for and used in the performance of the work, if that rent or allowance is reasonable and use of that plant has been approved by the Engineer;

49.2.5 payments for maintaining and operating plant is necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Engineer, are necessary for the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;

49.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;

49.2.7 payments for preparation, delivery, handling, erection, installation, inspection, protection and removal of the plant and material necessary for and used in the performance of the contract;

49.2.8 any other payments made by the Contractor with the approval of the Engineer that are necessary for the performance of the contract.

GC50 RECORDS TO BE KEPT BY CONTRACTOR

50.1 The Contractor shall

50.1.1 maintain full records of his estimated and actual costs of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto;

50.1.2 make all records and material referred to in GC50.1.1 available to audit and inspection by the Owner and the Comptroller General of the Government of the Nunavut or by persons acting on behalf of either or both of them when requested;

50.1.3 allow any of the persons referred to in GC50.1.2 to make copies of and to take extracts from any of the records and material referred to in GC50.1.1; and

50.1.4 furnish any person referred to in GC50.1.2 with information he may require from time to time in connection with such records and material.

50.2 The records maintained by the Contractor pursuant to GC50.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC43.1 was issued or until the expiration of such other period of time as the Owner may direct.

50.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly having control of the Contractor to comply with GC50.1 and GC50.2 as if they were the Contractor.

GC51 LITIGATION

51.1 This contract shall be deemed to have been made in Nunavut and shall be governed by the laws of Nunavut as far as applicable.

51.2 In the event of any legal action arising out of this agreement, the Contractor, if originating such action, may sue the Government of Nunavut in the name and style of "The Government of Nunavut" and the Government of Nunavut, if originating such action, may commence the action against the Contractor in his own behalf in the name and style of "The Government of Nunavut".

GC52 REQUIREMENTS FOR INUIT, LOCAL AND NUNAVUT CONTENT

52.1 The Contractor shall, in the performance of the Work, employ Inuit, Local and Nunavut workers and use Inuit, Local and Nunavut content to the greatest extent possible and at a minimum, no less than the amounts tendered by the Contractor in Appendix "B-2" of the tender. Workers shall meet all levels of proficiency, qualification and expertise as dictated by the authorities having jurisdiction and/or as defined in the contract documents.

52.2 The Contractor shall provide a schedule indicating the anticipated total monthly value of all Inuit, Local and Nunavut content and Labour to be expended in the execution of the Work. This schedule shall provide the benchmark for ensuring compliance by the Contractor with the requirements for the use of Inuit, Local and Nunavut content during the project.

52.3 For the Inuit Labour bonus or penalty, as set out in the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy, the benchmark shall be the minimum prescribed level for Inuit Labour identified on page 4 of Appendix K of the tender.

GC53 REQUIREMENT FOR COMMUNITY MEETINGS

53.1 The Contractor shall arrange meetings on a monthly basis, or other basis as may be mutually agreed by the parties to this contract, to monitor the use of Inuit, Local and Nunavut Labour and Inuit, Local and Nunavut content. The Contractor shall give the owner 3 to 5 days notice of all meetings called under GC53. The Contractor shall take reasonable steps to ensure that these meetings include the following representatives:

(a) A community representative who has been designated to speak on behalf of the community (if available),
(b) A community manpower representative (if available),
(c) The Contractor,
(d) The Owner's representative.

53.2 The Contractor shall arrange a Community Meeting prior to the start of construction and at that meeting shall:

(a) provide a schedule referred to in GC52.2 above to the community representative, or if no community representation is designated, shall provide a copy of this schedule to the Owner's representative,

(b) identify specific types of workers required during the project such as plumbers, painters or electricians and how many of those workers are required and when they are required and based on information received in accordance with GC53.2 (c) maintain a list of community manpower,

(c) request from the community manpower representative or from the Owner if no community manpower representative has been delegated, a list of workers available in the community,

53.3 The Owner shall attend all community meetings organized by the Contractor in accordance with GC53.3.2(c) and when requested by the Contractor shall:

(a) identify and contact potential community workers who may be available to be employed on the Work, identify alternate workers if those workers initially identified are not available to work, and assist in confirming the residency of local workers.

53.4 The Contractor shall arrange Community Meeting as required by GC53.1 and at those meetings shall:
(a) provide employment reports identifying workers used during the past month (to substantiate information provided on Appendix B-2),

(b) provide an amended schedule referred to in GC53.2, if necessary

(c) provide a consolidated report at the time of substantial completion, which shall confirm the total amount of Inuit, Local and Nunavut content used. This report will identify Inuit, Local and Nunavut payroll separately. This consolidated report shall be a condition precedent to the release of payment.

GC54 MONITORING THE LEVEL OF INUIT, LOCAL AND NUNAVUT LABOUR

54.1 The contractor is responsible to insure that every worker identified as Local or Nunavut meets the qualifying requirements of being ordinarily resident in Nunavut for the past 12 months, and for Local being a Nunavut resident ordinarily residing in the subject community for the past 4 months. The contractor may be required to provide proof of residency at any time throughout the project.

54.1.1 Reasonable proof of Nunavut and Local residency shall be any of the following:

a) is on the Nunavut Tunggavik Inc. (NTI) enrolment list and provides a physical address where residing,

or

b) has spent the last 12 months ordinarily resident in Nunavut and

i) has a valid Nunavut Health Care Card effective at least 9 months prior to start date of employment on the project;
and/or

ii) other accepted proof of residency such as: a Nunavut General Hunting License, a Nunavut Driver's Licence, a lease or rental receipt, or a certified Schedule T222 Income Tax return from the previous year or proof that Income Tax was paid in the Nunavut during the previous tax year;

and provides a physical address where residing.

or

c) is included on a list of approved Local or Nunavut residents verified by the municipality of their residence.

54.1.2 The Contractor is responsible to ensure that every worker identified as Inuit is on the NTI Inuit enrolment list, or would qualify to be on the list.

54.2 If requested by the Owner to do so, the contractor shall obtain a signed consent form from a worker which verifies their residency and permits the Owner to obtain any and all information required to support the worker's claim of residency and/or Inuit status. A standard consent form is attached as page 4 of Appendix "B" of the tender. A worker does not need to comply with the requirements of this clause 54.2 if the worker meets the requirements of GC54.1.1 (c).

GC55 FAILURE TO COMPLY WITH PROPOSED INUIT, LOCAL AND NUNAVUT CONTENT

55.1 The parties to this agreement recognize the high cost of living in Nunavut, and the need to build capacity of Inuit Firms and Labour in Nunavut, which is compensated for by the Owner through the provision of bid adjustments for the use of Inuit, Local and Nunavut Labour and other Inuit, Local and Nunavut content, and the provision of bonuses under the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy. It is a priority of the Owner to maximize the opportunities for Inuit; Local and Nunavut workers and businesses to benefit from government contracts and the Owner may pay a premium in awarding its contracts to support this important objective.

Therefore, it is a fundamental requirement of this contract that the Contractor shall achieve, by the completion of the contract, at least the amounts tendered on Appendix B-2 of the tender, with the exception of decreasing Nunavut content with a corresponding equal or larger increase in Local content, specifically:

(a) the amount of Inuit Labour.
AND

(b) (i) the amount of Local Labour and the amount of Nunavut Labour,
or
(ii) the amount of Local Labour and the total amount of Local and Nunavut Labour

which the Contractor has identified in Appendix B-2 of the Tender,

AND at least

(c) the amount of Inuit Content excluding the Labour of Inuit Firms,
AND
(d) (i) the amount of Local Content (excluding Local Labour) and
the amount of Nunavut content (excluding Nunavut Labour),
or
(ii) the amount of Local Content (excluding Local Labour) and
the total amount of Local and Nunavut content (excluding Local and Nunavut Labour),

which the Contractor has identified in Appendix B-2.

55.2 In the event that the amounts of Inuit, Local and Nunavut expenditures actually achieved by the Contractor are less than the amounts identified in clauses GC55.1 then the Owner MAY adopt one or more of the following remedies,

(a) withhold from any progress payment an amount equal to:

(i) the difference between the amounts identified in clause GC55.1 (a), (b)(i), or (b)(ii) and the amount identified in the Schedule referred to in GC52.2 and

(ii) the difference between the amounts identified in clause GC55.1 (c), (d)(i) or (d)(ii) and the amount identified the Schedule referred to in GC52.2.

This amount may be released to the contractor if at the date of a subsequent request the difference has been eliminated.

(b) deduct from the approved contract payment at the time of substantial or final completion an amount equal to:

(i) 25% of the difference between the amounts identified in clause GC55.1 (i), GC55.1. (ii), or GC55.1 (iii) and the amount identified in Appendix B-2 and

(ii) 25% of the difference between the amounts identified in clause GC55.1 (iv), GC55.1 (v), or GC55.1 (vi) and the amount identified in Appendix B-2 of the Tender.

(c) take the contract out of the Contractor's hands, in accordance with Clause 37 and GC38

55.3 In the event that the amount of difference identified in GC55.2 is 15% or less of the amount proposed in Appendix B-2 of the tender, the Owner, at its sole discretion, may waive the provisions of clause 55.2.

55.4 **In the event that the minimum prescribed level of Inuit Labour set out in Appendix K of the tender is not met, then for future tenders where there are similar minimum prescribed levels for Inuit Labour, the Contractor may be deemed not "responsible" as defined in the Government Contract Regulations.**

GC56 OBLIGATION TO PROVIDE CONTRACT SECURITY

56.1 Where the contract amount referred to in the Articles of Agreement is

56.1.1 less than $100,000, the Engineer may require at the expense of the Owner the Contractor to provide contract security prescribed in GC57.

56.1.2 $100,000 or more, the Contractor shall, at his own expense, provide one or more of the forms of contract security prescribed in GC57.

56.2 If the Contractor is required to provide contract security pursuant to GC57, the security shall be delivered to the Engineer within 14 days after the date that the Contractor receives notice that his tender or offer was accepted by the Owner.

GC57 PRESCRIPTION OF ACCEPTABLE CONTRACT SECURITY

57.1 If the Contractor is required to provide contract security pursuant to GC56, the Owner shall accept from the Contractor one or more of the forms of security prescribed in GC57.2.2 to GC57.6.

57.2 A Contractor shall deliver to the Owner:

57.2.1 A performance bond and a labor and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or,

57.2.2 A security deposit in an amount that is equal to 10% of the contract amount referred to in the Articles of Agreement.

57.3 A performance bond and a labour and material payment bond referred to in GC57.2 shall be in a form as approved by the Federal Treasury Board (Federal Contracts) and be issued by a bonding or surety company that is approved by the Owner.

57.4 The amount of a security deposit referred to in GC57.2.2 shall not exceed $250,000, regardless of the contract amount referred to in the Articles of Agreement.

57.5 A security deposit referred to in GC57.2.2, shall be in the form of

57.5.1 "A letter of irrevocable guarantee" in the form authorized by the contract authority payable to the Owner that is drawn on a bank to which the Bank Act or the Quebec Savings Banks Act applies; or

57.5.2 A certified cheque or bank draft from a bank acceptable to the Owner and made payable to the Owner.

57.6 The "letter(s) of irrevocable guarantee" referred to in GC57.5.1 shall be

57.6.1 Held uncashed until 14 days prior to their expiry date, unless the expiry date is extended for a further term, beyond the contract completion date stated in the Articles of Agreement.

57.7 The certified cheque as referred to in GC57.5.2 shall be deposited by the Owner into the Owner's bank account.

GC58 COMPREHENSIVE GENERAL LIABILITY INSURANCE REQUIRMENTS

58.1 Comprehensive General Liability Insurance with limits of not less than two million dollars inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof. This insurance shall be maintained continuously from commencement of the work until not less than twelve (12) months from the date of the Final Certification of Completion. The Owner is not to be added as an Insured under this policy. Such insurance shall include but is not limited to:

58.1.1 Premises, Property and Operations Liability;

58.1.2 Products and Completed Operations Liability;

58.1.3 Owners' and Contractors' Protective Liability;

58.1.4 Blanket Written Contractual Liability;

58.1.5 Non-Owned Automobile Liability;

58.1.6 Broad Form Property Damage Extension;

58.1.7 Use of explosives for blasting, shoring, excavating, underpinning, demolition, removal, pile driving and caisson work, work below ground surface, tunnelling and grading, as applicable;

58.1.8 Contingent Employer's Liability;

58.1.9 Person Injury Liability;

58.1.10 Employees As Additional Insureds;

58.1.11 Cross Liability With Respect To Additional Insureds;

58.1.12 Asbestos Abatement Liability, as applicable.

GC59 AUTOMOBILE LIABILITY INSURANCE REQUIREMENTS

59.1 Automobile Liability Insurance in respect of Contractor's owned and leased vehicles shall have limits of not less than two million dollars inclusive per occurrence for bodily injury, death, and damage to property. And when applicable:

- S.E.F. No. 4a Explosives Endorsement;

- S.E.F. No. 21b Blanket Fleet Endorsement.

GC60 AIRCRAFT AND WATER CRAFT LIABILITY INSURANCE REQUIREMENTS

60.1 Aircraft and Watercraft Liability Insurance with respect to owned or non-owned aircraft and watercraft if used directly in or indirectly in the performance of the Work, including use of airport premises, with limits of not less than one million dollars inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than one million dollars for Aircraft Passenger Hazard. Such insurance shall be in a form acceptable to the Owner.

GC61 GENERAL INSURANCE CONDITIONS

61.1 **Deductible:** Amount of deductible on any insurance provided by Contractor shall be borne in its entirety by Contractor.

61.2 **Waiver of Recourse:** Contractor waives all rights of recourse against the Owner for damages to Contractor's property or property of others for which Contractor is responsible and Contractor's Insurers have no right of subrogation against the Owner.

61.3 **Notice of Cancellation:** All required insurance shall be endorsed to provide the Owner with 30 days advance written notice of material change, cancellation or termination. Such notices shall be addressed to: The Owner (as noted on the Contractor's Certificate of Insurance).

61.4 **Other Insurance:** Contractor shall provide, maintain and pay for any additional insurance which is required to be provided by the Contract Documents, or by law, or which he considers necessary to cover risks not otherwise covered by insurance specified in these conditions.

61.5 Contractor's Certificate of Insurance: The Contractor shall complete the attached form "Contractor's Certificate of Insurance", and shall within 14 days after the acceptance of the tender deliver this completed certificate to the Owner. Substitute certificates will not be accepted; the Contractor must use this certificate.

GC62 PROPERTY INSURANCE (All "Risks" Course of Construction Insurance)

62.1 Insurance has been purchased by the Owner on a very broad basis, to protect as Insureds, all those who have direct participation in the construction project, for claims which may arise as a result of loss or damage during course of construction.

62.2 **Coverage:** "All Risks" of physical loss or damage or destruction while said project is in course of construction, site preparation, reconstruction, repair, erection, fabrication, testing, and including all materials, equipment machinery, structures, property, fitting, fixtures, betterment, and supplies of any nature whatsoever to enter into and form part of the finished project while at the site of operations or elsewhere in Canada or the Continental United States or America, all the property of the Insureds or the property of others for which the insureds have assumed responsibility, or for whom the Insured are required to carry insurance, including while on a river or lake crossing ferry in connection with land transportation..

62.3 **Exclusions:** This policy does not cover goods in transit to the site. This is the contractor's risk, which he may or may not wish to insure.

62.3.1 This policy does not cover the following types of construction and/or maintenance contracts:

a) Highways & Ferries;
b) Water & Sewer Contracts With No Buildings;

62.4 **Term:** From the commencement of work to the date of the Substantial Completion as certified by the Owner.

62.5 **Limit of Liability:** The limit of liability at the project site is the estimated full completed value of the project including, but not limited to, owner-supplied labour or materials, reasonable profit, insurance costs, overhead, taxes, labour, administrative fees and all other expenses which are incurred as additional costs as a result of a partial or total loss.

62.6 **Deductible:**

62.6.1 The Contractor shall be responsible for a deductible, which shall be equal to 5% of the considered insurable loss to a maximum of $10,000 per occurrence.

END OF GENERAL CONDITIONS

PART 1 - GENERAL

1.1 Pre-Construction Meeting

.1 Immediately prior to construction, upon notification, attend pre-construction meeting at place of Owner's choice along with site superintendent and authorized representatives of certain key subcontracts as specifically indicated in conference notice.

.2 Purpose of meeting is as follows:

.1 Review project communications procedures.

.2 Review contract administration requirements including submittals, payment and change order procedures.

.3 Identify all critical points on construction schedule for positive action.

.4 Identify any product availability problems and substitution requests.

.5 Review Architect's inspection requirements.

.6 Review any points which in Contractor's, Owner's or Architect's opinion, require clarification.

1.2 Site Meetings

.1 Prior to commencement of the work, Contractor and Architect shall mutually agree to a sequence for holding regular "on site" meetings.

.2 Organize all necessary site meetings. Ensure that persons, whose presence is required, are present and that relative information is available to allow meetings to be conducted efficiently.

.3 Architect will record minutes of each meeting and distribute copies to participants.

1.3 Progress Report

.1 Maintain on site, daily written record of progress of work. Record shall be open to inspection by Architect at all times and copy shall be furnished to Architect upon request.

.2 This record shall show weather conditions, dates of commencement, progress and completion of various trades and items of work, number of employees of various trades and type and quantity of equipment employed.

1.4 Record Drawings

.1 Obtain and keep on site at all times during construction, a complete and separate set of blue line white prints.

.2 Note clearly, neatly, accurately and promptly as the work progresses, all architectural, structural, mechanical and electrical changes, revisions and additional to the work and deviations from the Contract Documents.

.3 Accurate location, depth, position, size and type of concealed and underground services shall be included as part of these record drawings. These drawings shall be the basis for as-builts required in Section 01300.

1.5 Documents on Site

.1 Contractor's field office shall at all times, contain a complete set of Contract Documents (Drawings and Specifications) with all addenda, site instructions, change orders, reviewed shop drawings and samples, colour schedule, paint materials schedule, hardware list, progress reports and meeting minutes,. latest edition of the National Building Code of Canada.

END

PART 1 - GENERAL

1.1 General

.1 Unless indicated otherwise, make submissions to the Architect at his office.

.2 Make all submissions required by the Contract Documents with reasonable promptness and in orderly sequence so as to cause no delay in the work.

.3 Within 14 days after Architect's request, submit in form approved by the Architect, a schedule of shop drawings and sample submissions required for this project. Identify critical points on schedule to ensure delivery of items at required time.

1.2 Construction Schedule

.1 Within 14 days after award of Contract, submit in form approved by Architect construction schedule for work of entire Contract.

.2 Show in schedule, start and completion times of each item of work, including erection and dismantling of temporary facilities.

.3 Include with schedule, cash flow chart broken down on a monthly basis in an approved manner. Cash flow chart shall indicate anticipated Contractor's monthly progress billings from commencement of work until completion.

.4 Completely update schedule and cash flow chart whenever changes occur to scheduling and in a manner and at times satisfactory to Architect.

.5 Provide competent and experienced staff familiar with scheduling work of this type to prepare, maintain, revise, direct and check implementation of schedule.

1.3 Schedule of Values

.1 Within 21 days after contract award submit Schedule of Values set out in a form approved by the Architect. Revise values until approved by the Architect.

.2 Use Table of Contents of Specifications as basis for degree of breakdown required. Provide additional information if requested by Architect.

.3 Itemize the following general costs:
.1 Bonds, Insurance, Permits.
.2 Mobilization, Freight.
.3 Temporary Facilities.
.4 Project Administration.
.5 Operations & Maintenance Manuals.
.6 Asbuilt Drawings.

1.4 Samples and Shop Drawings

.1 Definitions:

.1 Samples are physical examples furnished by the Contractor to illustrate materials, equipment, workmanship or component parts such as mockups and prototypes, and to establish minimum standards by which the work will be judged.
.2 Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or a subcontractor, manufacturer, supplier or distributor, and which illustrate some portion of the work. Advertising literature will not be accepted.

.2 General:
.1 Review, stamp with approval and sign samples and shop drawings before submission to Architect. By approving and submitting samples and shop drawings, Contractor represents that field measurements, field construction criteria, materials, catalogue numbers and similar data have been verified and that samples and shop drawings have been checked and coordinated with requirements of the work and contract documents.

1.4 Samples and Shop Drawings.2 (Cont'd)

.2 General:(Cont'd)

At the time of submission, inform Architect in writing of any deviations in samples and shop drawings from requirements of Contract Documents.

.3 Architect will review samples and shop drawings for the sole purpose of ascertaining conformance with general design concept of the project and with information given in Contract Documents. Architect's review of a separate item shall not indicate acceptance of an assembly in which the item functions. This review by Architect shall not mean that Architect approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or his responsibility for meeting all requirements of the Contract Documents.

.4 Make corrections which Architect may require, consistent with Contract Documents, and resubmit new samples or modified shop drawings until reviewed.

.5 Direct specific attention in writing on re-submitted shop drawings to revisions requested by Architect on previous submissions.

.6 Be responsible for dimensions to be confirmed and correlated at job site for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all Sections.

.7 Shopd rawingss ubmitted inI mperialw ill ber eturned tot hec ontractorn otr eviewed untilw hich timet heya res ubmittedi nM etric Units(SI).

.8 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before receiving Architect's final review.

.9 No work requiring a sample or shop drawing submission shall commence until the

1.4 Samples and Shop Drawings.9 (Cont'd)

.2 General:(Cont'd)
(Cont'd)
submission has received Architect's final review. All such work shall be in accordance with reviewed samples and shop drawings.

.3 Sample Submissions:
.1 Submit samples with identifying labels bearing material or component description, manufacturer's name and brand name, Contractor's name, project name, location in which material or component is to be used, and date.
.2 Prepay any shipping charges involved for delivering samples to designation point and returning to point of origin, if required.

.4 Shop Drawing Submissions:
.1 Standard pre-printed shop drawings.

- Submit eight (8) copies of shop drawings: make submittals of more than 2 pages in individual booklet form; after final review Architect will return at least five (5) copies of shop drawings to the Contractor.

1.5 Record Photographs

.1 Where work concealed by subsequent work cannot be inspected by the Architect, submit record photographs as directed by the Architect. Provide sufficient number of photographs taken from different angles verifying that Contract requirments have been met. Failure to comply with this section will entitle the Architect to have work exposed as required.

.2 Record photographs shall be in colour on a 128 x 178 mm glossy format, taken with sufficient lighting for adequate exposure and in focus.

.3 **Bi-WeeklyS tatusP hotoss hallb et aken throughout thep rojecta ndc ompiledi ntoa manuala nd turnedo vert ot hea rchitect.A ll Photoss hallb ed atedf orw hent heyw ere**

1.5 Record Photographs (Cont'd)	.3	(Cont'd) **taken.T his isar equirement ofS ubstantial Completion.**
1.6 Record Drawings	.1	As per requirements of Section 01721.
1.7 Operating and Maintenance Manuals	.1	As per requirements of Section 01721.

END

PART 1 - GENERAL

1.1 Appointment and Payment

.1 Owner may appoint and pay for services of independent testing agencies except for the following:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.5 Tests specified to be carried out by Contractor under the supervision of Architect.

.2 Where tests or inspections by designated testing agency reveal work to be not in accordance with contract requirements, Contractor shall pay costs for additional test or inspections as Architect may require to verify acceptability of corrected work.

1.2 Duties and Authority of Testing Agencies

.1 Testing agency is expected to do the following:

.1 Act in a professional and unprejudiced manner and carry out inspection and testing functions to establish compliance with requirements of Contract Documents.

.2 Check work as it progresses. Failure to detect defective work or materials shall not in any way, prevent later rejection when such defect is discovered, nor shall it obligate Architect for final acceptance.

.3 Prepare reports stating results of tests and conditions of work and state in each report whether specimens tested conform to requirements of Contract Documents, specifically noting deviations.

.4 Distribute reports as follows:

.1 Architect - 2 copies.

1.2 Duties and Authority of Testing Agencies (Cont'd)

.1 (Cont'd)

.4 Distribute reports as follows:(Cont'd)

.2 Owner - 2 copies.

.3 Contractor - 2 copies.

.2 Testing agency is not authorized to amend or release any requirements of Contract Documents, not to approve to accept any portion of work.

1.3 Contractor's Responsibilities

.1 Furnish labour and facilities to:

.1 Provide access to work to be inspected and tested.

.2 Facilitate inspections and tests.

.3 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Architect sufficiently in advance of operations to allow for assignments of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Architect.

.5 Employment of independent testing agency shall in no way relieve Contractor of his obligation to perform work in accordance with requirements of Contract Documents.

END

PART 1 - GENERAL

1.1 General Instructions

.1 Building systems will be serviced as outlined in Section 01700 upon acceptance of the work by the owner.

.2 The use of building systems will in no way affect the performance of the work on the schedule.

.3 Notwithstanding use of building systems, all services outlined herein shall be provided as required.

.4 Provide, operate and maintain all temporary facilities and controls required for the proper execution of the work.

.5 Location of temporary facilities shall be subject to Architect's approval.

.6 Install and maintain temporary systems in accord with applicable regulations and requirements.

.7 Provide barriers, guards and scaffolding to Government of Nunavut Industrial Safety Regulations.

PART 2 - PRODUCTS

2.1 Materials

.1 Materials used for temporary facilities are not required to be new, provided they are in sound structural condition.

PART 3 - EXECUTION

3.1 Offices and Sheds

.1 Construction Office: maintain until completion of contract, temporary office as required for work, large enough to accommodate site administrative activities and site meetings and complete with light, heat, ventilation, phone and fax, table and chairs.

.2 Storage Sheds: Provide temporary covers, sheds and platforms of weatherproof construction as may be required for protection of materials, tools, equipment susceptible to damage. Provide heated storage facilities as required, to protect frost susceptible materials.

3.2 First Aid

.1 Provide site equipment and medical facilities necessary to supply first-aid service to injured personnel in accordance with the GN Industrial Safety Regulations First Aid Service requirements and the regulations of the Workmen's Compensation Act. Maintain facilities for duration of Contract.

3.3 Utilities and Services

.1 Sanitary Facilities: Toilet facilities for all personnel on the work will be assigned by the Owner. The Contractor will be responsible to keep facilities clean and sanitary and provide with supplies at all times. Remove wastes from site.

.2 Water:

.1 Supply water to site for all trades.

.2 Conveniently locate water supply for use by all Sections of work. Protect water lines against freezing.

.3 Water shall be potable and meet requirements specified under technical Sections of Specifications.

3.3 Utilities and Services (Cont'd)

.3 Temporary Heating:

.1 Furnish equipment, labour and fuel to provide temporary heat as required for proper execution of new work.

.2 Upon completion of sheet vapour retarder installation, heat enclosed new construction to minimum 10 degrees C at all times. See other specification Section for intermittent heating requirements up to 21 degrees C.

.3 All equipment and appliances to be used are subject to the approval of the office of the Fire Marshall,Community Government & Transportation, Governments of Nunavut, Iqaluit,NU.

.1 Electric Heaters shall be designed and installed in accordance with the requirements of CSA Standard C22-1 - Canadian Electrical Code.

.2 Liquid Fuel Fired Heating Appliances shall be installed in accordance with the requirements of CAN/CSA-B139-M91 - Oil Burning Equipment. Heating appliances using gasoline or Naptha type fuels shall be permitted.

.3 Gas Fired Heating Appliances shall be installed in accordance with the requirements of CSA Standards B149.1 and B149.2 - Gas Burning Appliances and Equipment.

.4 Solid Fuel Fired Heating Appliances or Salamanders shall be of substantial construction, with an ash receiving bottom, a solid top and legs at least four inches high. They shall be set so that they cannot be readily overturned and vented by means of permanent flue connection. The floor shall be either non-combustible, or if combustible, shall be protected by a sheet of asbestos of not less than 1/4 inch thick covered with a sheet of metal of not less than No. 24 US Gauge. Such protection shall extend beyond the base of the heater, 36 inches in front and 24 inches at each side and rear.

.5 Clearances from combustible construction or combustible material shall be of not less than 36 inches

3.3 Utilities and Services (Cont'd)

.3 Temporary Heating: (Cont'd)

.3 (Cont'd)

.5 (Cont'd)

above, 48 inches in front and 36 inches on each side and rear.

.6 Flue Pipes shall be adequately supported and installed with at least 18 inches clearance from combustible construction or material.

.7 Hot Air or Exhaust Ducts shall be constructed of non-combustible material and be adequately supported.

.8 Internal Combustion Engines driving heaters shall be removed to the outdoors for refuelling of the engine, where practicable.

.4 The General Contractor will be responsible for all temporary heat systems required throughout the entire building program.

.5 A mutual form of agreement shall be signed with the Owner accepting responsibility and obligations relating to the using of new heating systems for temporary heat.

.6 Make use of the building's heating system under the following conditions:

.1 All costs relating to the installation of necessary additional piping shall be the responsibility of the General Contractor.

.2 All water, if to be returned to a central boiler plant, must return in an uncontaminated condition.

.3 No portion of any new mechanical system or equipment provided under Mechanical Sections may be used for temporary heating without Consultant's written permission.

.4 All equipment must be maintained as recommended by the manufacturer.

.5 Regularly oil and grease motor, fan and pump bearings, etc., and check on a routine basis.

.6 Regularly check and clean, when necessary, permanent type filters, and finally clean and oil just prior to takeover of building by owner.

3.3 Utilities and Services (Cont'd)

.3 Temporary Heating: (Cont'd)

.6 (Cont'd)

.7 Replace throw away type filters in air handling equipment as needed.

.8 Replace filters of oil burning equipment as needed.

.9 Ensure that mechanical air handling equipment is not operated during painting or sanding stages.

.10 Certify in writing that all systems and equipment are in proper condition, and guarantee all work used prior to takeover as for new work, from the date of acceptance of the building by the owner.

.11 If permission for temporary use of new mechanical equipment is granted, use the Government of Nunavut Standard Form of Agreement as basis of responsibilities.

.12 Guarantee on complete installation shall not start until acceptance of building by owner.

.13 All costs to provide temporary heat shall be paid by the General Contractor.

.14 All worn or damaged parts shall be replaced to the satisfaction of the engineer.

.15 Where air systems must be used during temporary heating, the general contractor shall provide additional filter media on all return and exhaust air outlets to protect the duct systems from dust and dirt. If, in the opinion of the Engineer, the duct systems have been excessively dirty, the General Contractor shall pay for all costs involved in thoroughly cleaning all duct systems. Heavy duct power vacuum cleaners may be required should such a condition arise.

.16 The General Contractor will be responsible to maintain voltages required for equipment used for temporary heating.

.4 Telephone:

.1 Provide construction office telephone and facsimile service for duration of Contract until completion.

3.3 Utilities and Services (Cont'd)

.5 Temporary Use of Permanent Equipment:

.1 Do not use any permanent service or piece of equipment without Owner's written approval. Comply with Owner's instructions regarding use of permanent services and equipment.

.2 Permanent services and equipment shall be 100% complete and in proper operating condition before they may be used as temporary facilities.

.3 Permanent services and equipment being used as temporary facilities shall be inspected and checked on a regular basis during use. If required, perform repairs and maintenance immediately after each inspection. Upon termination of temporary use period, services and equipment shall be inspected, tested, adjusted, balanced and cleaned. Permanent services and equipment shall be turned over to Owner in new and perfect operating condition.

3.4 Environmental Controls

.1 Protect excavation and frost sensitive building materials from freezing.

.2 Provide and maintain adequate temporary pumping and drainage systems to keep excavations and structures free of water.

.3 Do not bury rubbish and waste materials on site.

.4 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into the ground, waterways or sewers.

.5 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

.7 Do not burn rubbish and waste materials on site.

3.5 Barriers and Protection

.1 Provide dust tight enclosures separating all work from the occupied or used parts of the building.

.2 Protect general public and workmen from injury. Construct and maintain required guardrails and guardlights.

.3 Provide as required, to permit work to continue without interruption, tarpaulins, plastic or wood covering to close in building prior to installation of windows, doors and screens.

.4 Protect work from damage with suitable protective coverings, barriers and devices.

.5 Keep floor surfaces dry and free from oil, grease and other foreign matter.

.6 Reinforced non-staining Kraft building paper and plywood or planking shall be laid over all types of finished floor surfaces in traffic areas and before moving any materials over finished areas.

3.6 Construction Aids

.1 Structures, Shoring and Bracing:

.1 Provide temporary structures, shoring and bracing required.
.2 Safely brace temporary structures to withstand all loads likely to be applied.

.2 Scaffolds:
.1 Provide scaffolds required for proper execution of work.
.2 Support scaffolds from finished surfaces only after taking precautions to prevent damage. No supports, clips, brackets, or similar devices shall be welded, bolted, otherwise affixed to any finished members of surface without prior approval.

3.6 Construction Aids (Cont'd)

.3 Use of permanent systems and equipment as temporary facility shall not affect the warranty period for such systems and equipment. Make due allowance so as to ensure that Owner will receive full benefits of equipment manufacturer's warranty after project takeover.

.4 Provide competent persons to operate and maintain permanent systems for duration of temporary use period.

3.7 Safety and Security

.1 Safety:

.1 Maintain fire protection for work.
.2 Supply and maintain portable fire extinguishers in the building until taken over by Owner. The extinguishers shall remain the property of the Contractor and shall be removed at the time of acceptance.
.3 Store paints and volatile oils in a separate location and inspect frequently.
.4 Keep storage of gasoline to a minimum. Do not store inside building but in a gasoline drum with a tap secured by a padlock.
.5 Inspect temporary wiring, drop cords, extension cables, for defective insulation or connections at frequent intervals.

.2 Security:

.1 Be responsible for security of all areas affected by work of this Contract, until taken over by Owner.
.2 Take steps to ensure against entry to the work by unauthorized persons and guard against theft, fire and damage by any cause.
.3 Guard all materials delivered to and temporarily stored at the job site against theft, vandalism and damage. Replace at no extra cost to Owner, any materials lost, stolen or damaged.

3.8 Project Sign

.1 The Project Construction Sign will be supplied by the Department of Public Works and Services in 24" x 48" (600 mm x 1200 mm) modular panels.

The Contractor will be responsible for packing freight and insurance from Great Slave Graphics in Yellowknife.

The Contractor will erect the sign within 48 hours of first materials arriving on site.

The Contractor will be responsible for ensuring that the erected sign remains plumb, vertical and upright for the duration of the project.

.2 Installation:

.1 Project identification sign to be installed at a location designated by Project Officer.

.2 Framing and foundation 4" x 4" (89 x 89 mm) select structural White Spruce, Douglas Fir or Western Red Clear dressed four sides.

.1 Apply 5% pentachlorophenol solution in petroleum solvent or chromated copper arsenate water borne formulation, wood preservatives to framing members below or in contact with ground in accordance with preservative manufacturer's instructions.

.3 Fasteners" aluminum or hot dip galvanized steel nails: hot-dip galvanized or cadmium coated screws.

.4 Paint: three coats alkyd type without silicone additives - 1st coat alkyd primer - 2nd and 3rd coats - alkyd gloss. CGSB 1-CP-28M.

.5 Colours:

.1 Framing members and signboard back: Off-White: GP4598W or Benjamin Moore 16-11.

.2 Signboard face (touch up only): Off-White: GP4598W or Benjamin Moore 16-11. Black: Standard black.

.6 Set signboard plumb and level.

END

PART 1 - GENERAL

1.1 Quality

.1 Products supplied for work shall be new and as far as possible and unless otherwise specified, of Canadian manufacture.

.2 Materials used for temporary facilities may have been previously used, provided they are of sound structural quality.

1.2 Standards and Terminology

.1 Where a standard has been adopted by these Specifications, incorporate minimum requirements of such standards into the work. Where requirements of Specifications are more stringent than those of the standard, follow more stringent requirements.

.2 Reference to standards, specifications, hand-books and manufacturer's catalogues refer to latest edition thereof and all amendments or revisions applicable at Tender Closing Date, unless date suffix is included with document number.

.3 Where a standard designates authorities such as, the "Ministry", the "Purchaser" or some other such designation, these designations shall be taken to mean "Architect".

.4 Wherever words "acceptable", "approved", "satisfactory", "selected", "directed", "designated", "permitted", "inspected", "instructed", "required", "submit" or similar words or phrases are used in standard or elsewhere in Contract Documents, it shall be understood that "by (to) the Architect" follows, unless context provides otherwise.

.5 Where the words "provide" or "furnish" are used in Contract Documents, they shall be taken to mean "supply and install" unless specifically noted otherwise.

1.3 Certification

.1 Building materials, components and elements specified without the use of trade or proprietary names shall meet requirements specified.

.2 If requested by Architect, submit evidence of meeting requirements specified. Evidence shall consist of certification based on tests carried out by an independent testing agency.

.3 Certification based on previous tests for same materials, components or elements is acceptable. Certification shall be in form of written test reports prepared by testing agency.

1.4 Availability and Substitutions

.1 Products which are specified by their proprietary names or by part or catalogue number form the basis for Contract. No substitutes for these may be used without Architect's approval in writing.

.2 Where it is found that specified materials have become unavailable for incorporation into work, notify Architect immediately of proposed substitution.

.3 Proposed substitutions shall be any product considered by Architect to be equal quality and value to that specified and suitable for purpose intended.

.4 Products proposed as substitutions which are considered by Architect to be suitable for purpose intended but which are in his opinion, of lesser value and quality than those specified, shall only be accepted as substitutions if reasonable credits are allowed for their use. Any alternate or substitute proposed by the Contractor shall be listed in Appendix "F", showing the effect on stipulated price.

.5 In order to substantiate equivalency of proposed materials, products or processes, submit samples, printed product descriptions,

1.4 Availability and Substitutions (Cont'd)

.5 (Cont'd) test data, installation instructions, standards, certification, sample, guarantee/warranty forms, list of successful projects incorporating such products and similar information requested by Architect.

.6 Whenever a substitute is proposed, any change to contract price as a result of acceptance of proposed product shall include any adjustments to adjacent structure or space in order to accept minor differences in size or weight between proposed items and corresponding specified items.

.7 Prevent any substitution or request for substitution from delaying construction progress in any way.

.8 Requests for substitution resulting from failure to place orders in time will not be entertained. Be responsible for ordering products in time to ensure their required delivery; bear all costs for failure to comply with these requirements.

1.5 Product Delivery, Handling and Storage

.1 Suitably pack, crate and protect products during and transportation to site to preserve their quality and fitness for the purpose intended.

.2 Store products in original, undamaged condition with manufacturer's labels and seals intact until they are being incorporated into completed work.

.3 Handle and store materials in accordance with manufacturer's and supplier's recommendations so as to ensure preservation of their quality and fitness for work.

.4 Arrange materials so as to facilitate prompt inspection, and remove faulty, damaged or rejected materials immediately from site.

1.6 Workmanship

.1 All work shall be carried out in accordance with the best trade practice by mechanics skilled in the type of work concerned.

.2 Products, materials, systems and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the applicable manufacturer's printed directions.

.3 Where specified requirements are in conflict with manufacturer's written directions, follow manufacturer's's directions. Where specified requirements are more stringent than manufacturer's directions, comply with specified requirements.

END

PART 1 - GENERAL

1.1 Section Includes

.1 Cleaning.

.2 Project record documents.

.3 Spare parts and maintenance materials.

.4 Take over procedures.

1.2 Related Sections

.1 Section: 01721 Project record Documents

.2 Division 15 - Mechanical

.3 Division 16 - Electrical

1.3 Progressive Cleaning

.1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other Contractors.

.2 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.3 Remove waste material and debris from the site at the end of each working day.

.4 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.4 Final Cleaning

.1 Keep the Work clean and suitable for occupancy by Owner.

.2 Remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.

1.4 Final Cleaning (Cont'd)

.3 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.4 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.

.5 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.6 Wax, seal, shampoo or prepare floor finishes, as recommended by the manufacturer.

.7 Broom clean and wash exterior walks, steps and surfaces.

1.5 Spare Parts and Maintenance Materials

.1 Spare parts and maintenance materials provided shall be new, not damaged or defective, and of the same quality and manufacture as Products provided in the Work. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Defective Products will be rejected, regardless of previous inspections. Replace products at own expense.

.3 Store spare parts and maintenance materials in a manner to prevent damage, or deterioration.

.4 Provide spare parts, special tools, maintenance and extra materials in quantities specified in individual specification Sections.

.5 Provide items of same manufacture and quality as items in the Work.

1.6 Final Inspection and Declaration Procedures

.1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required. Notify the Consultant in writing of satisfactory completion of the contractor's Inspection and that corrections have been made. Request a Consultant's Inspection.

.2 Submittal of Documents:

.1 Submit required documents at least 15 working days prior to Application for Substantial Completion Inspection.

.2 Collect reviewed submittals and assemble documents executed by subcontractors, suppliers and manufacturers.

.3 Submit operations and maintenance manuals, record drawings, maintenance materials, spare parts and tools.

.4 Provide warranties and bonds fully executed and notarized.

.5 Execute transition of Performance and Materials Payment Bond to warranty period requirements.

.6 Submit a final statement of accounting giving total adjusted contract price, previous payments and monies remaining due.

.3 Items Required for Owner Takeover:

.1 Following items are required for Owner Takeover of building (after declaration of Substantial Completion). Provide at Substantial Completion Inspection or earlier as specified.

.1 Project keys
.2 Occupancy Permits
.3 Fire Marshal's Clearance
.4 Electrical Inspection Certificates
.5 Boiler Inspector's Certificates
.6 Security System verification
.7 Record Drawings
.8 Air and Hydronic Balancing Reports
.9 Operating and Maintenance Manuals
.10 Instructions to Owner on operation of all systems.
.11 List of Subtrades who will handle warranty work.

1.6 Final Inspection and Declaration Procedures (Cont'd)

.3 Items Required for Owner Takeover: (Cont'd)

.1 (Cont'd)

.12 Arrangements for reading of all meters by Public Utilities and the changeover of billing.

.13 Maintenance materials and spare parts and tools.

.4 Consultant's Inspection: Consultants and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.

.5 Declaration of Substantial Completion: When the Engineer and Consultants consider deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for Certificate of Substantial Completion.

.6 Submittals:

.1 Within one week after Certificate of Substantial Completion is issued, submit schedule for completion of deficiencies, for Consultant's approval.

.2 Within two weeks after Certificate of Substantial Completion is issued, submit warranties, bonds and guarantees fully executed and notarized.

.7 Final Inspection: When the items noted above are complete, request a final inspection of the Work by the Owner, Consultants, and the Contractor. If Work is deemed incomplete by the Consultant, complete the outstanding items and request a reinspection.

.8 Commencement of Lien and Warranty Periods: The date of the Owners acceptance of the submitted declaration of Substantial Performance shall be the date for commencement for the warranty period and commencement of the lien period unless required otherwise by the lien statute of the Place of the Work.

1.6 Final Inspection and Declaration Procedures (Cont'd)

.9 Declaration of Total Performance: When the Consultants consider final deficiencies and defects have been corrected and it appears requirements of the Contract have been totally performed, make application for certificate of Total Performance. Refer to General Conditions Article GC 13 and 14 for specifics to application. If work is deemed incomplete by the Consultant, complete the outstanding items and request a reinspection.

.10 Final Payment: Following completion of the lien period, submit claim for final payment in accordance with the General Conditions.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END

PART 1 - GENERAL

1.1 Section Includes

.1 Record documents, samples, specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Warranties and bonds.

1.2 Related Sections

.1 Section 01300 - Submittals: Shop drawings, samples, manufacturers instructions, photographs.

.2 Section 01400 - Quality Control: Test and inspect reports.

.3 Divisions 15 and 16 - Testing, Adjusting and Balancing of Systems: Test and balance, system performance verification and takeover procedures.

.4 Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.3 Submission

.1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

.2 Submit one copy of completed volumes in English in final form four weeks prior to application for Substantial Completion.

.3 Copy will be returned with Consultant comments.

.4 Revise content of documents as required prior to final submittal.

1.3 Submission (Cont'd)	.5	Four weeks prior to submitting Application for Substantial Completion of the work, submit to the Consultant, one final copy of operating and maintenance manuals.
1.4 Format	.1	Organize data in the form of an instructional manual. "Manual": An organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified in individual sections of Divisions 02 - 16.
	.2	Binders: to be supplied in three "D" ring binders.
	.3	Assemble, coordinate and index required data into submission.
	.4	Arrange content by systems, under Section numbers and sequence of Table of Contents.
	.5	Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
	.6	Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
	.7	Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
	.8	Type all lists and notes.
	.9	Drawings, diagrams and manufacturers literature must be legible
1.5 Contents, Each Volume	.1	Table of Contents: provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

1.5 Contents, Each Volume (Cont'd)

.2 For Each Product or System: list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01400.

.6 Submission:

.1 Cover sheet containing:

.1 Date submitted.

.2 Project title, location and project number.

.3 Names and addresses of Contractor, and all Sub-contractors.

.2 Table of Contents.

.3 List of maintenance materials as specified in Section 01750 - Spare Parts and Maintenance Materials.

.4 List of spare parts as specified in Section 01750 - Spare Parts and Maintenance Materials.

.5 Warranties, guarantees.

.6 Copies of approvals, and certificates.

.7 Provide data as specified in individual sections of Divisions 02 to 16.

.1 List of equipment including service depot.

.2 Nameplate information including equipment number, make, size, capacity, model number and serial number.

.3 Parts list.

.4 Installation details.

.5 Operating instructions.

1.5 Contents, Each Volume (Cont'd)

.6 Submission: (Cont'd)

.7 (Cont'd)

.6 Maintenance instructions for equipment.

.7 Maintenance instructions for finishes.

.7 Shop drawings:

.1 Bind separately one complete set of reviewed final shop drawings and product data.

1.6 Record Documents andcopy of: Samples

.1 Maintain at the site for Owner one record

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store Record Documents and Samples in Field Office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain Record Documents in a clean, dry and legible condition. Do not use Record Documents for construction purposes.

.5 Keep Record Documents and samples available for inspection by Consultant.

1.7 Recording Actual Site Conditions

.1 Record information on a set of blue line opaque drawings, provided by Owner.

.2 Provide waterproof felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
.1 Measure depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by change orders.
.6 Details not on original Contract Drawings.
.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalog number of each project actually installed, particularly optional items and substitute items.
.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 At completion of project and prior to final inspection, neatly transfer notations from the as-built drawings to the clean set of drawings and submit both sets to the Consultant. Once

1.7 Recording Actual Site Conditions (Cont'd)	.7	(Cont'd) as-built drawings are accepted, the contractor will produce the contract Record Drawings from these documents. Record Documents shall be provided to the owner in both hard and soft copies.
1.8 Equipment and Systems	.1	Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
	.2	Panelboard Circuit Directories: provide electrical service characteristics, controls, and communications.
	.3	Include installed colour coded wiring diagrams.
	.4	Operating Procedures: include start-up, break- in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
	.5	Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
	.6	Provide servicing and lubrication schedule, and list of lubricants required.
	.7	Include manufacturer's printed operation and maintenance instructions.
	.8	Include sequence of operation by controls manufacturer.

1.8 Equipment and Systems (Cont'd)

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01400 and 01660.

.15 Additional Requirements: As specified in individual specification sections.

1.9 Materials and Finishes

.1 Building Products, Applied Materials, and Finishes: include product data, with catalog number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommend schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.10 Warranties and Bonds

.1 Separate each warranty or bond with index tab sheets keyed to the List of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

END

PART 1 - GENERAL

1.1 Related Work

.1 Section 01300 - Submittals.

.2 Section 02315 - Excavating, Trenching and Backfilling.

.3 Section 03300 - Cast-in-Place Concrete.

1.2 Description of Work

.1 This contract includes, but is not necessarily confined to the following:
.1 The design, supply and assembly of all material for the installtion of thermosyphons under the New Sewage Treatment Plant, Pangnirtung, Nunavut.
.2 The provision of an assembly crew, including certifed welders, skilled and experienced in the field assembly in the event the thermosyphons are too large to ship in one piece.
.3 Provide termporary bracing unitl final anchoring to building is possible.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.
.1 Indicate connector hardware and installation instructions.
.2 Provide desgn analysis and prodcut date to demostrate adequacy of the system and compliance with the required design criteria.
.3 All shop drawings to be signed and sealed by Professional Engineer registered with NAPEGG.

1.4 Maintenance Data

.1 Provide Operating and Maintenance data for incorporation into Manual described in Section 01721.

1.5 Codes and Standards

.1 Perform work in accordance with all local codes and requirements of the authorities having jurisdiction.

.2 All welds to meet ASME boiler and pressure vessel codes.

1.6 Preformance Criteria

.1 The thermosyphons shall have sufficient heat removal capacity to annually refreeze the thawing that will occur beneath the building during the summer based on the following design criteria.

.1 Climatic information as published by the Atmospheric Environment Service of Environment Canada and asindicated on the drawings.

.2 Design floor temperature of 20°C.

.3 150mm of rigid insulation under the floor slab.

.4 Granular pad thermal properties to be based on density of 200Kg per cubic metre at 7% moisture content.

.5 Use safety factor of 2.0.

.6 Average winds speed to be reduced by 50%.

PART 2 - PRODUCTS

2.1 Material

.1 Thermosyphons shall be two phase liquid-vapour type thermosyphons carged wtih carbon dioxide refigerant.

.2 Vertical portions of the thermosyphon including the radiator shall be sandblasted, galvanized and painted with a near white epoxy paint.

.3 Thermosyphon steel pipe shall be consturcted to A53B.

.4 Radiators to be segmented fin type, 89mm O.D. pipe with 32mm high x .012mm nominal thickness x 4 rows of carbon steel fins per 25mm.

PART 3 - EXECUTION

3.1 Installation

.1 Trenches shall be excavated to the requied grades as shown on the drawings and as per the manufacturers design requirements. Care shall be taken to sensure cobbles of large stones will not be in contact with the pipe.

.2 Thermsyphons to be placed on a 100mm thick layer of clean sand bedding, and shall be covered with an additional 10mm thick layer of clean sand over the pipe. The remainder of the backfill shall be compacted to conform with the remainder of the gravel pad.

.3 Heavy equipment sahll not pass over the thermosyphons until they have been covered wtih 300mm minimum fill.

.4 Thermosyphons shall be accurately placed ot dimensions shown on the drawings.

3.2 Quality Control

.1 Thermosyphons shall be completely checked for leaks once they have been charged using a leak detecting solution.

END

PART 1 - GENERAL

1.1 Related Work	.1	Cast in place Concrete:	Section 03300

1.2 References

.1 ASTM C 117-95, Test Method for Material Finer Than: 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C 136-96a, Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D 698-91(1998), Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 2.49 kg Rammer and 304.8 mm Drop.

.4 ASTM D 1557-91, Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 4.54 kg Rammer and 457 mm Drop.

.5 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 Definitions

.1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m^3.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan and frozen materials.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.4 Protection of Existing Features

.1 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Consultant before moving or otherwise disturbing utilities or structures.

.5 Advise Consultant to re-route existing lines in area of excavation. Costs for such work will be paid by Owner.

.6 Record location of maintained, re-routed and abandoned underground lines.

.2 Existing buildings and surface features:

.1 Conduct, with Consultant, condition survey of existing buildings, trees and other plants, service poles, wires, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

1.5 Samples

.1 At least 4 weeks prior to commencing work, inform Consultant of proposed source of fill materials and provide access for sampling.

.2 If required, ship samples prepaid to agency selected by Consultant, in tightly closed containers to prevent contamination.

1.6 Measurement for Payment

.1 Work performed under this Section will be considered incidental to work involved in Section 03300.

.2 Shoring, bracing and de-watering of excavation will not be measured separately for payment.

.3 Backfilling to authorized excavation limits will be considered incidental to the work.

PART 2 - PRODUCTS

2.1 Materials

.1 Type 1 and Type 2 fill:

.1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C 136-96a and ASTM C 117-95. Sieve sizes to CAN/CGSB-8.1-88.

Sieve Designation		% Passing	
		Type 1	Type 2
75	mm	-	100
50	mm	-	-
37.5	mm	-	-
25	mm	100	-
19	mm	75-100	-
12.5	mm	-	-
9.5	mm	50-100	-
4.75	mm	30-70	22-85
2.00	mm	20-45	-
0.425	mm	10-25	5-30
0.180	mm	-	-
0.075	mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by Consultant for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Type 4 fill: Clean sand.

2.1 Materials (Cont'd)

.4 Type 5 fill: 25 mm Crush.

Sieve Designation	% Passing
25 mm	100
20 mm	95-100
10 mm	60-80
4.75 mm	40-60
2.36 mm	28-48
600 micro m	13-29
300 micro m	9-21
150 micro m	6-15
75 micro m	4-10

.5 Type 6 fill: 75 mm Minus Screened Gravel.

Sieve Designation	% Passing
75 mm	100
40 mm	60-80
20 mm	40-66
10 mm	25-54
4.75 mm	15-43
2.36 mm	10-35
600 micro m	5.23
150 micro m	3-12
75 micro m	2-10

PART 3 - EXECUTION

3.1 Site Preparation

.1 Grading may be required to level the site and provide surface drainage. Prior to base leveling pad construction, the subgrade should be checked to detect any extremely soft or loose areas. Any such areas should be over-excavated and replaced with engineered gravel fill. An appropriate engineered fill would be 75 mm minus. The recommended gradation for this type of gravel is described in a table above as "Type 6" fill. All snow and ice must be removed prior to the placement of any fill material.

3.1 Site Preparation (Cont'd)

.2 Ideally, fill placement would commence as soon as the borrow material is unfrozen and the soil can be compacted in an unfrozen state. If significant thaw of the base of the subgrade occurs prior to fill placement, initial settlement of the pad may occur prior to complete freezeback.

.3 An engineered granular pad should be placed directly over the compacted base leveling pad. The granular pad material should be a well-graded 25 mm crush and contain less then 10% fines. The recommended gradation for this type of gravel is described in a table above as "Type 5" fill. Other gradations may be appropriate but should be reviewed by a geotechnical engineer. The pad shculd be thick enough so that the finish floor and the grade within 3.0 m of the building is greater then 0.3 m above the surrounding grade.

.4 All gravel should be placed in lifts not exceeding 150 mm compacted thickness and compacted to a minimum of 100 % standard Proctor maximum dry density. No gravel should be placed that is in a frozen state. The crest of the granular pad should extent to 3 m beyond the exterior perimeter of the building. The side slopes beyond 3 m from the building should slope 2H : 1V or flatter.

.5 We recommend that the gravel pad be instrumented with thermistor strings to monitor freezeback. If necessary to expedite freezeback, the cooling system could be connected to an external mechanical refrigeration system.

3.2 Foundation Monitoring

.1 Compaction testing should be carried out at all phases of construction to confirm that adequate degree of compaction are obtained.

3.3 Installation of Underslab Pipes and

.1 Depending on type of piping being used, suitable bedding and padding such as sand may be required. Uniform compaction of any bedding or padding, and the gravel below, around and above the ducts is important for the provision of a stable foundation pad.

3.4 Site Grading and Drainage

.1 Adequate drainage is required near the building to reduce the potential thermal and physical erosion. A drainage plan should be implemented to drain surface water away from the areas adjacent to the proposed building. Special measures may be required to intercept and divert downslope surface run-off and shallow, active layer seepage. An upslope swale should be considered.

.2 For areas immediately adjacent to the building, design grades should promote rapid drainage and should be sloped a minimum of 3% over a distance of 2 meters in order to shed water away from the structure.

.3 Downspouts for eaves troughs should be directed away from the building with the discharge point at least 1.5 meters from the exterior of the building. This will reduce the potential for erosion for of the subgrade adjacent to the structure. Other areas on the site should be graded to drain at slopes of at least 2% away from the building.

3.5 Stockpiling

.1 Stockpile fill materials in areas designated by Consultant. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.6 Dewatering and Heave Prevention

.1 Site excavation must be protected from the inflow of surface and groundwater at all times.

.2 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.

3.7 Excavation

.1 Excavate to lines, grades, elevations and dimensions as indicated.

.2 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

.3 Dispose of surplus and unsuitable excavated material off site as directed by Consultant.

.4 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.5 Adequate level of monitoring has to be provided during the excavation by the Consultant.

.6 Obtain Consultant approval of completed excavation.

.7 Remove unsuitable material and organics from building site to extent and depth as directed by Consultant.

.8 The excavation must be protected from the moisture, dessication, frost action and construction traffic.

3.8 Fill Types and Compaction

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from corrected maximum dry density.

.1 Perimeter thickened footings: Use Type 5 fill to subgrade level. Compact to 100% Standard Proctor Maximum Dry Density. Compacted thickness of lifts should not exceed 150 mm.

.2 Within building areas: Use type 5 fill. Backfill to rise the grade below the slab should be placed in lifts not exceeding 150 mm in compacted thickness and compacted to at least 100% Standard Proctor maximum dry density. Moisture conditioning should be applied to the structural fill if required.

.2 Adequate level of monitoring has to provided by the Consultant during earthworks, monitoring compaction and compaction testing. All bearing surfaces have to be inspected prior to concrete slab and foundation placement.

3.9 Backfilling

.1 Do not proceed with backfilling operations until Consultant has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed .600 m.

3.10 Restoration

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as directed by Consultant.

.2 Clean and reinstate areas affected by work as directed by Consultant.

END

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Specifications for aggregates and soils and the compaction of aggregates and soils refer to ASTM Sieve Analyses and ASTM Tests.

.2 Other materials are specified with reference to CGSB Standards, CSA Standards, ASTM Standards and ASCII Standards.

1.2 SUBMITTALS

.1 Five (5) days after award of Contract the CONTRACTOR shall submit to the ENGINEER for review, a complete and detailed outline of the procedures and methods that he will employ for this section of the WORK.

.2 The CONTRACTOR shall not begin work until the ENGINEER has reviewed the submittal.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the site and store in a manner such that granular materials are kept in separate piles and manufactured materials are stored according to the recommendations of the Manufacturer.

.2 Sand and gravel material required shall be selected from available local sources. These sources shall be subject to the ENGINEER'S approval and Land Use Permits must be obtained by the CONTRACTOR for the use of said materials.

.3 The CONTRACTOR is advised that screening of the material, especially for the fine gravel and sand, may be required to meet the SPECIFICATIONS. The CONTRACTOR shall at no additional cost to the OWNER screen and blend materials from one or more sources to achieve the gradations shown and to permit compaction to the required levels called for in this Section.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING (Cont'd)

.4 The OWNER reserves the right to have sampling of granular material and concrete as well as compaction tests carried out by an independent material testing firm to satisfy himself the SPECIFICATIONS are met. Should results indicate that the SPECIFICATIONS are not met, all costs related to the sampling, testing and correction of the problem will be charged to the CONTRACTOR, unless the CONTRACTOR can produce proof of compliance.

.5 Frozen material and ice will not be accepted as backfill material.

1.4 JOB CONDITIONS AND REGULATIONS

.1 Perform work under observation of the Safety Act and General Safety Regulations of the Nunavut Territory.

.2 Perform work in a manner that will cause the least disruption to traffic.

.3 The CONTRACTOR is responsible for posting of warning and traffic signs; supply and placing of barricades and protective hoarding.

1.5 QUALITY ASSURANCE

.1 Submit to the ENGINEER a list of sources of materials including sand, gravel and borrow materials.

.2 Provide samples, test results, sieve analyses and reports for preliminary approval of materials.

1.6 MINIMUM QUALITY CONTROL TEST FREQUENCIES

.1 The following frequencies of testing are the minimum required. The CONTRACTOR shall perform as many tests as are necessary to ensure that the WORK conforms to the requirements of the CONTRACT regardless of the minimum number specified.

1.6 MINIMUM QUALITY CONTROL TEST FREQUENCIES (Cont'd)

.2 Provide moisture/density curves for each type of material from each source of material to be compacted to a specified density.

.3 Field densities:

- Structures and Embankments (from excavated material)-for each 4000 m2 of compacted layers.
- Subgrade Preparation - one field density for every 2000 m2 of 150 mm compacted layers.

1.7 DISPOSAL

.1 All materials on site whether stockpiled, stored or excavated are the property of the OWNER, and the OWNER reserves the right to keep any part or all of the material.

.2 The CONTRACTOR shall dispose of debris, waste, unsuitable material, rock or excess material in accordance with the SPECIFICATIONS.

.3 The CONTRACTOR is encouraged to reuse materials encountered on site to the extent they comply with the SPECIFICATIONS in this Section.

.4 Disposal sites will be designated by the ENGINEER.

.5 The CONTRACTOR shall dispose of all materials at sites to be located by the CONTRACTOR.

PART 2 - PRODUCTS

2.1 GRANULAR MATERIALS

.1 Fine Gravel: refer to section 02223

.2 Coarse Gravel: refer to section 02223

.3 Sand shall comply with the following gradation. It shall be native, clean, salt free, well graded, organic free, rounded or angular pieces containing no more than 4% particles smaller than the No. 200 sieve.

Sieve Size	Percent Passing
10 mm	100
No. 4	80 - 100
No. 16	50 - 75
No. 50	15 - 75
No. 100	2 - 8

Sand shall be used as topping material below and above membranes and where otherwise called for on the DRAWINGS.

2.2 COMMON FILL

.1 Shall be native material found on site or imported, and free of stones larger than 100 mm in size, of frozen matter, of rubbish and organics or vegetation.

2.3 RIP RAP

.1 Use Class 1 Nominal Size 300 mm hand placed rock rip rap.

.2 Rip Rap shall be:

- 100% smaller than 450 mm or 136 kg
- 20% larger than 350 mm or 68 kg
- 50% larger than 300 mm or 36 kg
- 80% larger than 200 mm or 11 kg

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

.1 General

.1 The CONTRACTOR is advised that the DRAWINGS and SPECIFICATIONS are not based on a legal survey of the existing facilities or detailed survey information of existing site conditions.

.2 The location of property limits, fences and bench mark are shown on the Plans. The CONTRACTOR is responsible to maintain and safeguard these throughout the construction period.

.3 Should a bench mark have to be relocated for the purpose of construction, it shall be relocated on a permanent structure and properly identified.

.4 The elevations and dimensions shown on the DRAWINGS are for the purpose of construction, measurement and evaluating progress payments. The CONTRACTOR shall ensure that final elevations are adhered to.

.5 The OWNER reserves the right to carry out independent testing of backfill materials and concrete as indicated above.

.2 Placing and Compaction of Backfill Material

.1 Backfill material shall be in accordance with the Specifications outlined in 2.1 above.

.2 Refer to section 02223 for placing and compaction requirements.

.3 Compaction equipment shall consist of a vibratory roller with an operating weight of not less than 1000 kilograms, or other equipment of similar capacity acceptable to the ENGINEER. Light hand operated compactors, such as Jumping jacks, and tracked equipment will not be considered adequate for compaction of tank foundations. The CONTRACTOR shall control the moisture level in the backfill

3.1 CONSTRUCTION METHODS (Cont'd)

.2 (Cont'd)

.3 (Cont'd)

material so as to achieve the required compaction levels.

3.2 CLEAN-UP

.1 The CONTRACTOR shall clean-up and dispose of all excess material, boulders and other debris as the WORK progresses.

.2 Before the WORK is considered complete, the CONTRACTOR shall remove all construction equipment, appliances, barricades, surplus materials, etc., and do such other work as may be necessary to leave the site or any other premises occupied by him in a neat, workmanlike condition, as required by the ENGINEER.

END OF SECTION 02224

PART 1 - GENERAL

1.1 Related Work

.1 Excavating, Trenching and Backfilling: Section 02223

1.2 Scope of Work

.1 It is intended that all finish grades are to be achieved with the addition of new material.

1.3 Site Conditions

.1 Known underground and surface utility lines and buried objects are as indicated on site plan.

1.4 Protection

.1 Prevent damage to fencing, landscaping, natural features, bench marks, surface or underground utility lines which are to remain. Make good any damage.

.2 Protect permafrost by filling and compacting excavated areas back to original grade or finish grade within same working day. No excavation is to be left open for more than one 24 hour period.

PART 2 - PRODUCTS

2.1 Materials

.1 Fill material: Type 1 in accordance with Section 02223.

.2 Obtain approval from Consultant of excavated or graded material used as fill for grading work. Protect approved material from contamination.

PART 3 - EXECUTION

3.1 Grading

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Grade ditches to depth required for maximum run-off as indicated.

.3 Compact filled and disturbed areas to Standard Proctor Density:
.1 95% under driveways, walk areas, parking and access road.
.2 100% under building.

3.2 Testing

.1 Inspection and testing of soil compaction may be carried out by designated testing laboratory.

.2 Costs of tests will be paid by Owner.

3.3 Surplus Material

.1 Spread on site or remove surplus material from site as directed by the Consultant.

.2 Remove material unsuitable for fill, grading or landscaping from site as directed by the Consultant.

END

PART 1 - GENERAL

1.1 Material Certification

.1 Submit manufacturer's test data and certification that materials meet requirements of this section at least two (2) weeks prior to commencing work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.2 Measurement for Payment

.1 Thermal insulation for underground piping will not be measured separately for payment. It is incidental to other sections.

1.3 Application

.1 Insulation for watermains and water service connections including fittings, chambers and appurtenances. Intent is for a fully insulated water system.

.2 Insulation for sanitary sewer mains and/or sanitary service connection only where indicated.

.3 Ensure that all pipe ends are capped prior to shipment.

PART 2 - PRODUCTS

2.1 Pipe Insulation

.1 Factory applied closed cell polyurethane insulation to a thickness of 50 mm, meeting the following requirements.

.1 Core density: ASTM D 1622-98 35-48 kg/m3.

.2 Closed cell content, ASTM D 2856-94(1998), 90% minimum.

.3 Water absorption: ASTM D 2482-97 .012g/cm3.

4 Thermal Conductivity @ 25 degrees C 0.00225 w/m degrees C (ASTM D2326).

2.1 Pipe Insulation (Cont'd)

.1 (Cont'd)

.5 Compressive strength @ 25 degrees C, 10% deflection 2.81/kg/cm2 (ASTM D 1621-00).

.6 Upper thermal limit; 121 degrees C.

.7 Dimensional stability, ASTM D 2126-99, procedure B & E; 3.

.8 Cut back insulation at each end to permit jointing.

2.2 Protective Jacket

.1 1.14mm thickness of continuously extruded high density polyethylene over rubber mastic under-adhesive. (Shaw Pipe Protection, 'Insul 8' system)

.2 Two layer spirally wrapped high density polyethylene tape, hot applied, counter-wound, overlapped 15% of tape width on each seam, total 1.27 mm thickness. (Urecon Ltd., 'U.I.P.' system or Thermal Pipe Systems.)

.3 Above ground piping sections:

.1 Locked seam galvanized steel (18 gauge) O-pipe jacket (Urecon Spiwrap System)

.2 Insulated pipe joints shall be completed using prefabricated polyisocyanurate or urethane foam half shells and metal consistent with that on the factory insulated pipe. All metal overlaps at the joints and fittings shall be 50mm minimum and shall be field positioned in such a way as to shed water.

.4 Pipe transitions from above ground to buried conditions require polyethelene and steel protective jackets.

2.3 Acceptable Systems

.1 Shaw Pipe Protection 'Insul 8'.

.2 Urecon Ltd. 'UIP'.

.3 Urecon Spiwrap system.

2.4 Joint and Fitting Insulation

.1 Polyurethane halfshell molded for joints or fittings to be snug fit meeting same requirements as for pipe.

.2 Heat shrink sleeve; cross linked, adhesive coated polyethylene sleeve to provide moisture proof seal. Canusa Heat Shrink Pipe Sleeve.

.3 Heat shrink tape; thermoclad adhesive coated, heat shrinkable tape in minimum 100 mm width. Raychem.

.4 Mastic; Flintguard VB110-14 asphalt mastic vapour barrier.

.5 Field applied urethane; portable urethane foam kit.

2.5 Board Insulation

.1 Extruded polystyrene suitable for underground use.

.2 Acceptable product: DOW Styrofoam H-40.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean all surfaces prior to applying adhesives, polyurethane, halfshells, mastic, heat shrink sleeves or tape. Remove and replace any material where proper bond is not achieved.

.2 Transport, store, and handle insulated components to avoid damage to insulation and/or protective jacket.

.3 Repair damaged insulation with field-applied urethane foam. Repair damaged protective jacket with heat shrink tape.

3.2 Jointing

.1 Do jointing as required. Use hand cutting tools to cut back insulation on pipe or half shells to provide snug fit. Do not use motorized tools.

.2 Coat all exposed surface of pipe insulation with mastic. Coat all surfaces of half shell before installation.

.3 Install half-shells.

.4 Fill gaps and areas(where preformed insulation cannot be installed) with field applied urethane. Use forms where required. Trim field applied urethane to contour of pipe or fitting after curing. Coat field applied urethane with mastic.

.5 Apply heat shrink sleeve or tape according to manufacturers directions. Where the geometry of fittings does not permit use of heat shrink sleeves, apply double wrap (counterwound) heat shrink tape with 50% overlap.

.6 Do not backfill over mastic coated surfaces for four (4) hours following mastic application.

END

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 INSPECTION AND HANDLING

.1 All material is subject to inspection and test for soundness and suitability at the discretion of the Engineer.

.2 All pipe shall be jointed in strict adherence to the manufacturer's instructions, which are considered as being part of these Specifications. As each section of the system is completed,it shall be tested in the manner specified, and in the presence of, and as approved by, the Engineer.

.3 All material found, during the progress of the work, to have cracks, flaws, or other defects, or to be doubtful quantity will be rejected by the Engineer. All rejected materials shall be promptly removed from the site of the work by the Contractor.

.4 All material shall be delivered and distributed at the site by the Contractor. All pipe, fittings,valves, hydrants and access vaults shall be loaded and unloaded by lifting manually or with hoists so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Insulated pipe shall not be skidded on the ground or against pipe already on the ground. Maintain manufacturer's recommendations for handling and transporting all materials.

.5 In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid on the trench.

.6 Pipe shall be handled so that the exterior and interior surfaces, prefabricated joints, etc. will not be damaged. If, however, any part any surface, coating or lining is damaged, the repair shall be made by the

2.1 INSPECTION AND HANDLING (Cont'd)

.6 (Cont'd) Contractor at his own expense, to standard equivalent to work specified.

2.2 HIGH DENSITY POLYETHYLENE PIPING

.1 The pipe for outfall piping High Density Polyethylene (HDPE).

.2 The high density polyethylene pipes shall be manufactured from Type 3, Class C, Category 5, Grade P34 resin according to ASTM D 1248-00a. The polyethylene pipe must meet the toxicity requirements of CSA B137 Series-99. The pipe shall be designated P.E. 3408 (800 HDS) and meet the requirements of ASTM F 714-00.

.3 All polyethylene pipe, fittings, stub ends, conduits, etc., shall be of the same series rating and manufacturer and the same grade of polyethylene.

2.3 BUTT FUSION STUB ENDS

.1 Butt fusion stub ends shall be provided by the same manufacturer who produces the HDPE pipe and shall be of an equivalent or higher series rating than the pipe it is joined to.

2.4 STEEL PIPING

.1 Steel piping to be sched 80.

.2 Interior of Steel outfall line to be coated with coal tar epoxy enamel.

2.5 WARNING TAPE

.1 To be colour coded Brady Identoline Tape (W.H. Brady Inc., Rexdale, Ontario) or Allen Markline (Allen Systems, Houston, Texas), polyethylene with a 4-mil minimum thickness, or equal.

.2 Imprint: black letters, one side only, repeated continuously:
.1 "Caution Buried Sewer Line Below".

PART 3 - EXECUTION

3.1 PREPARATION

.1 Clean pipes, fittings, and appurtenance of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 PIPE INSTALLATION

.1 Lay pipe on prepared bed, true to line and grade.

.2 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.3 Keep joining materials and installed pipe free to dirt, water and other foreign materials. Whenever work is stopped, install a removal watertight bulbhead at open end of last pipe laid to prevent entry of foreign materials.

.4 Do not lay pipe on frozen bedding.

.5 Flanged collars to be fused to polyethylene pipe shall be made from the same type and grade of polyethylene, from the same raw material supplier, as the pipe. Under no circumstances will socket fusion joints be permitted.

.6 Pipe shall be joined by thermal butt-fusion.

3.3 INSPECTION CERTIFICATES

.1 Written inspection certificates shall be issued to the Contractor for various phases of the work after the work has been inspected by the Engineer and has been found to comply with the plans and specifications. Inspection certificates are required for work that is to be covered by other work or backfill. Payment shall not be made for work requiring an inspection certificate until the certificate has been issued by the Engineer. The Engineer

3.3 INSPECTION CERTIFICATES (Cont'd)

.1 (Cont'd)
shall issue an inspection certificate immediately after approval of a phase of the work. The issuance of an inspection certificate shall not relieve the contractor from his obligation to maintain the work or replace work subsequently found to be faulty. The temporary absence of the Engineer from the site shall not relieve the Contractor from his obligation to obtain inspection certificates.

END

PART 1 - GENERAL

1.1 Related Work	.1	Concrete Reinforcement Section 03200
	.2	Cast-in-Place Concrete Section 03302
1.2 References	.1	CSA A23.1-94, Concrete Materials and Methods of Concrete Construction.
	.2	CSA O86.1-94, Engineering Design in Wood (Limit States Design).
	.3	CAN3-O86-M84, Supplement No. 1-1987, to CAN3-O86-M84, Engineering Design in Wood (Working Stress Design) and O86.1-94 Engineering Design in Wood (Limit States Design).
	.4	CSA O121-M1978, Douglas Fir Plywood.
	.5	CSA O151-M1978, Canadian Softwood Plywood.
	.6	CSA S269.1-1975, Falsework for Construction Purposes.
	.7	CAN/CSA-S269.3-M92, Concrete Formwork.
1.3 Measurement for Payment	.1	No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

PART 2 - PRODUCTS

2.1 Materials

.1 Formwork materials:
.1 For concrete without special architectural features, use plywood and wood formwork materials to CAN3-O86-M84.

.2 Form ties:
.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.

.3 Form liner:
.1 Plywood: Douglas Fir to CSA O121-M1978 , #2 grade, square edge, 19 mm thick.

.4 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

.5 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm^2/s at 40°C, flashpoint minimum 150°C, open cup.

.6 Falsework materials: to CSA S269.1-1975.

PART 3 - EXECUTION

3.1 Fabrication and Erection

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Consultant's approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

3.1 Fabrication and Erection (Cont'd)

.4 Fabricate and erect falsework in accordance with CSA S269.1-1975.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.6 Do not place shores and mud sills on frozen ground.

.7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3-M92 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1-94.

.9 Align form joints and make watertight. Keep form joints to minimum.

.10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners of concrete members, joints, unless specified otherwise.

.11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.13 Clean formwork in accordance with CSA A23.1-94, before placing concrete.

3.2 Removal and Reshoring

.1 Leave formwork in place for following minimum periods of time after placing concrete.
.1 3 days for walls and sides of beams.
.2 7 days for columns.

3.2 Removal and Reshoring (Cont'd)

.1 (Cont'd)
.3 4 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.
.4 3 days for footings and abutments.

.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Re-use formwork and falsework subject to requirements of CSA A23.1-94.

END

PART 1 - GENERAL

1.1 Related Work	.1	Cast-in-Place Concrete	Section 03300
	.2	Formwork and Falsework	Section 03100

1.2 References	.1	ANSI/ACI 315-80, Details and Detailing of Concrete Reinforcement.
	.2	ANSI/ACI 315-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
	.3	CSA A23.1-94, Concrete Materials and Methods of Concrete Construction.
	.4	A23.3-94, Design of Concrete Structures for Buildings.
	.5	CSA G30.5-M1983, Welded Steel Wire Fabric for Concrete Reinforcement.
	.6	CSA G30.14-M1983, Deformed Steel Wire for Concrete Reinforcement.
	.7	CSA G30.15-M1983, Welded Deformed Steel wire Fabric for Concrete Reinforcement.
	.8	CSA G40.21-98, Structural Quality Steels.
	.9	CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 Source Quality Control	.1	Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.

1.3 Source Quality Control (Cont'd)	.2	Upon request inform Consultant of proposed source of material to be supplied.
1.4 Shop Drawings	.1	Submit shop drawings including placing of reinforcement in accordance with Section 01300.
	.2	Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada. ANSI/ACI 315-80 and ANSI/ACI 315-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
	.3	Detail lap lengths and bar development lengths to A23.3-94, unless otherwise indicated. Provide type A tension lap splices where unless otherwise indicated.
1.5 Measurement for Payment	.1	No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.
1.6 Substitutes	.1	Substitute different size bars only if permitted in writing by Consultant.

PART 2 - PRODUCTS

2.1 Materials

.1 Reinforcing steel: billet steel, grade 350 400, deformed bars to CAN/CSA-G30.18-M92, unless indicated otherwise.

.2 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18-M92.

.3 Cold-drawn annealed steel wire ties: to CSA G30.3-M1983.

.4 Deformed steel wire for concrete reinforcement: to CSA G30.14-M1983.

.5 Welded steel wire fabric: to CSA G30.5-M1983. Provide in flat sheets only.

.6 Welded deformed steel wire fabric: to CSA G30.15-M1983. Provide in flat sheets only.

.7 Chairs, bolsters, bar supports, spacers: to CSA A23.1-94.

.8 Mechanical splices: subject to approval of Consultant.

2.2 Fabrication

.1 Fabricate reinforcing steel in accordance with CSA A23.1-94, ANSI/ACI 315-80, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. ANSI/ACI 315-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.

.2 Obtain Consultant's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

PART 3 - EXECUTION

3.1 Field Bending

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.2 Placing Reinforcement

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1-94.

.2 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

END

PART 1 - GENERAL

1.1 Related Work	.1	Concrete Reinforcement Section 03200
	.2	Concrete Forms and Accessories Section 03100
	.3	Concrete floor Hardeners Section 03361
1.2 Standard	.1	Concrete materials and methods of construction: to CSA A23.1-94 94 unless otherwise specified.
1.3 Inspection	.1	Concrete testing: to CSA A23.2-94 by testing laboratory designated and paid for by Consultant. Accelerated test methods will apply.
	.2	Give Consultant minimum 48 h notice before each concrete pour.
1.4 Shop Drawings	.1	Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.
	.2	Detail reinforcing steel in accordance with Manual of Standard Practice of Reinforcing Steel Institute of Ontario (RSIO).
	.3	Each drawing submitted showing formwork and falsework design shall be in accordance with CSA A23.1-94 94, and bearing stamp and signature of professional engineer registered or licensed in the Northwest Territoriess, Canada.

PART 2 - PRODUCTS

2.1 Materials

.1 Portland cement: to CAN/CSA-A5-93, Type 10.

.2 Shrinkage compensating grout: pre-mixed, non-metallic aggregate, 50 MPa compressive strength at 28 days.

.3 Reinforcing bars: to CAN/CSA-G30.18-M92, Grade 400.

.4 Welded steel wire fabric: to CSA G30.5-M1983

.5 Premoulded joint filler: bituminous impregnated fibreboard to ASTM D 1751-83(1991).

.6 Joint sealer/filler: grey, to CAN/CGSB-19.24-M90, Type1, Class B black, cold applied, to CAN/CGSB-19.20-M87 M87, Type 1.

.7 Floor hardener: non-metallic, pre-mixed.

.8 All other concrete materials: to CSA A23.1-94.

2.2 Mix Proportions

.1 Method: Alternative (1) of CSA A23.1-94.

.2 Cement type: as specified under 2.1.

.3 Minimum 28 day compressive strengths and exposure classifications:
.1 All concrete: 28 MPa; C-4.

.4 Nominal size of coarse aggregate: Clause 14 of CSA A23.1-94 94 .

.5 Slump: to Table 6 of CSA A23.1-94 94 .

.6 Air content: all concrete to contain purposely entrained air in accordance with Table 10 of CSA A23.1-94 94.

.7 Admixtures: to Clause 6 of CSA A23.1-94.

PART 3 - EXECUTION

3.1 Inserts

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by Consultant .

3.2 Finishes

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1-94.

.2 Interior floor slabs to be left exposed smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CSA A23.1-94 to produce hard, smooth, dense trowelled surface free from blemishes; finishing tolerance classification: Flat.

.3 Hardened floor finish: as specified in 3.2.2 immediately above in conjunction with application of hardener applied 2.44 kg/m n .

.4 Floor slabs to receive mortar bed for ceramic or quarry tile: screed to correct grade to provide broomed texture; finishing tolerance classification: Conventional.

.5 Equipment pads: smooth trowelled surface; finishing tolerance classification: Very Flat.

.6 Pavements, walks, curbs and exposed site concrete: screed to plane surfaces and float using aluminum, magnesium, or wood floats. Round edges and provide joint spacings using standard tools. Trowel smooth followed by lightly brushed non-slip finish.

3.3 Control Joints	.1	Cut and form control joints in slabs on grade at locations indicated, in accordance with CSA A23.1-94. Fill with HILTI CP6015 elastomeric sealant or equall.
3.4 Expansion and Isolation Joints	.1	Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface.
3.5 Curing	.1	Cure and protect concrete in accordance with CSA A23.1-94, except that curing compounds shall not be used where bond is required by subsequent topping or coating.
3.6 Grout	.1	Grout voids under baseplates.
	.2	Grout into place, bolts and other items of concrete hardware, that are not placed prior to pouring concrete.
	.3	Mix and place grout.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 03302 Cast-in-Place Concrete : Curing and tolerances.

1.2 References

.1 Canadian Standards Association (CSA)
.1 CSA A23.1-94, Concrete Materials and Methods of Concrete Construction.

1.3 Product Data

.1 Submit product data in accordance with Section 01300.

.2 Include application instructions for concrete hardener.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01340. Indicate VOC content.

1.4 Environmental Requirements

.1 Temporary lighting
.1 Minimum 1200W light source, placed 2.5 m above floor surface, for each 40m n of floor being finished.

.2 Electrical power
.1 Sufficient electrical power to operate equipment normally used during construction.

.3 Work area
.1 Water tight protection against rain and detrimental weather conditions.

.4 Temperature
.1 Maintain ambient temperature of not less than 10 C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
.2 Maintain substrate temperature at 10 C minimum.

1.4 Environmental Requirements (Cont'd)

.5 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

.6 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Provide continuous ventilation during and after coating application.

PART 2 - PRODUCTS

2.1 Floor Hardener

.1 Non-metallic hardener: premixed, dry shake surface hardener, cement to hardener ratio 2 to 1 , cement colour to match floor finish schedule, light reflective.

2.2 Colouring Agent

.1 Non-metallic type cement colouring agent, colour selected by Consultant .

PART 3 - EXECUTION

3.1 Hardening

.1 Apply floor hardener aggregate in accordance with manufacturer's written instructions.

3.2 Protection

.1 Protect finished installation until floor treatment has completely cured.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 05210 - Steel Joists.

.2 Section 05310 - Steel Deck.

.3 Section 05500 - Metal Fabrications.

.4 Section 13127 - Prefabricated Buildings.

1.2 References

.1 Canadian Standards Association (CSA).
.1 CSA G40.20-98, General Requirements for Rolled or Welded Structural Quality Steel.
.2 CSA G40.21-98, Structural Quality Steels.
.3 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
.4 CAN/CSA-S16.1-94, Limit States Design of Steel Structures.
.5 CSA S136-94, Cold Formed Steel Structural Members.
.6 CSA W47.1-92, Certification of Companies for Fusion Welding of Steel Structures.
.7 CSA W48 Series-M1980 to M1992, Electrodes.
.8 CSA W55.3-1965, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
.9 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding) Metric.

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.40-M89, Primer Structural Steel, Oil Alkyd Type.
.2 CAN/CGSB-1.140-M89, Oil-Alkyd Type Red Lead, Iron Oxide Primer.
.3 CGSB 85-GP-14M, Painting Steel Surfaces Exposed to Normally Dry Weather.
.4 CAN/CGSB-85.100-93, Painting.

.3 American Society for Testing and Materials (ASTM).

1.2 References (Cont'd)

.3 (Cont'd)

.1 ASTM A 325M-97, Specification for High-Strength Bolts for Structural Steel Joints Metric.

.4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

.1 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2 -75, Quick-Drying, Primer for use on Structural Steel.

1.3 Shop Drawings

.1 Submit shop drawings including fabrication and erection documents, and materials list in accordance with Section 01300.

.2 On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings.

.3 All fabricator designed assemblies, components and connections, and drawings to be stamped and signed by qualified professional engineer licensed in the Northwest Territories of Canada.

1.4 Design of Details and Connections

.1 Design details and connections in accordance with requirements of CAN/CSA-S16.1-94 and CSA S136-94resist forces, moments, shears and allow for movements indicated.

.2 If connection for shear only (standard connection) is required:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction".

.2 If shears are not indicated, select or design connections to support reaction from maximum uniformly distributed load that can be

1.4 Design of Details and Connections (Cont'd)

.2 (Cont'd)
.2 (Cont'd)
safely supported by beam in bending, provided no point loads act on beam.

.3 For non standard connections, submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Northwest Territories, Canada.

1.5 Quality Assurance

.1 Upon request, submit 2 copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work at least 4 weeks prior to fabrication of structural steel.

PART 2 - PRODUCTS

2.1 Materials

.1 Structural steel: to CSA G40.21-98 Grade 350W as indicated and/or CSA S136-94.

.2 Bolts, nuts and washers: to ASTM A 325M-97.

.3 Welding materials: to CSA W48 Series CSA W59-1989 and certified by Canadian Welding Bureau.

.4 Shop paint primer: to CAN/CGSB-1.40-M89 CAN/CGSB-1.140 CISC/CPMA 1 CISC/CPMA 2.

.5 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164-M92, minimum zinc coating of 600 g/m^2.

2.2 Fabrication

.1 Fabricate structural steel in accordance with CAN/CSA-S16.1-94 CSA S136-94 and in accordance with approved shop drawings.

.2 Continuously seal members by continuous welds intermittent welds and plastic filler where indicated. Grind smooth.

2.3 Shop Painting

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16.1-94, CSA S136-94, CAN/CGSB-85.100-93 except where members to be encased in concrete.

.2 Clean all members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC SPI (brush) blast.

.3 Apply one coat of CISC/CMPD2-75 primer in shop to all steel surfaces to achieve minimum dry film thickness of 7 to 10 mils, except:
.1 Surfaces to be encased in concrete.
.2 Surfaces and edges to be field welded.
.3 Faying surfaces of friction-type connections.
.4 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5°C.

.5 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 General

.1 Structural steel work: in accordance with CAN/CSA-S16.1-94 and CSA S136-94.

.2 Welding: in accordance with CSA W59-1989.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1-92 for fusion welding of steel structures and/or CSA W55.3-1965 for resistance welding of structural components.

3.2 Connection to Existing Work	.1	Verify dimensions and condition of existing work, report any discrepancy and potential problem areas to Consultant for direction before commencing fabrication.
3.3 Marking	.1	Mark materials in accordance with CSA G40.20-98. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
	.2	Match marking: shop mark bearing assemblies and splices for fit and match.
3.4 Erection	.1	Erect structural steel, as indicated and in accordance with CAN/CSA-S16.1-94, CSA S136-94 and in accordance with approved reviewed erection drawings.
	.2	Field cutting or altering structural members: to approval of Engineer Consultant.
	.3	Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
	.4	Continuously seal members by continuous welds where indicated. Grind smooth.
3.5 Field Quality Control	.1	Inspection and testing of materials and workmanship may be carried out by testing laboratory designated by Consultant.
	.2	Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Consultant.
	.3	Submit test reports to Consultant within two weeks of completion of inspection.
	.4	Owner will pay costs of tests as specified in Section 01410 - Testing Laboratory Services.

3.6 Field Painting .1 Paint in accordance with Section - 09911 - Painting.

.2 Touch up all damaged surfaces and surfaces without shop coat with primer to CAN/CGSB-1.40-M89 except as specified otherwise. Apply in accordance with CGSB 85-GP-14M.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 09911 - Interior Painting.

.2 Section 05310 - Steel Deck.

.3 Section 05121 - Structural Steel for Buildings.

.4 Section 05500 - Metal Fabrications.

1.2 References

.1 Canadian Standards Association (CSA).
.1 CSA G40.20-98, General Requirements for Rolled or Welded Structural Quality Steel.
.2 CSA G40.21-98, Structural Quality Steels.
.3 CAN/CSA-S16.1-94, Limit States Design of Steel Structures.
.4 CSA S136-94, Cold Formed Steel Structural Members.
.5 CSA W47.1-92, Certification of Companies for Fusion Welding of Steel Structures.
.6 CSA W55.3-1965, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
.7 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding) Metric.
.8 CSA W59-1989, Supplement No. 1 to W59-M1989 Welded Steel Construction (Metal Arc Welding).

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.40-M89, Primer Structural Steel, Oil Alkyd Type.
.2 CAN/CGSB-1.105-M91, Quick Drying Primer.
.3 CGSB 85-GP-14M, Painting Steel Surfaces Exposed to Normally Dry Weather.
.4 CAN/CGSB-85.100-93, Painting.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
.1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.

1.2 References (Cont'd)

.3 (Cont'd)

.2 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.

1.3 Quality Assurance

.1 At least 4 weeks prior to fabrication of steel joists and accessories, submit two copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work. Such mill test reports shall be certified by qualified metallurgists confirming that tests conform to requirements of CSA G40.20-98 and CSA G40.21-98.

1.4 Design of Steel Joists and Bridging

.1 Design steel joists and bridging to carry loads indicated in joist schedule shown on drawings in accordance with CAN/CSA-S16.1-94 CSA S136-94.

.2 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.

.3 Limit natural frequency of joist/floor system to maximum 9.2 Hz.

.4 Perform floor vibration analysis as directed by Consultant.

.5 Limit floor joist deflection due to specified live load to 1/360 of span and deflection due to specified total load to 1/240 of span.

.6 Submit 7 copies of calculations and joist design drawings for typical joists for Consultant approval at least 4 weeks prior to fabrication and/or delivery.

1.5 Shop Drawings

.1 Submit shop details and erection drawings in accordance with Section 01300.

1.5 Shop Drawings (Cont'd)

.2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Northwest Territories, Canada.

.3 On erection drawings, indicate relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and other details.

.4 In shop details, provide particulars relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.

PART 2 - PRODUCTS

2.1 Materials

.1 Open web steel joists:
.1 Acceptable material: Omega Joists Ltd. / Canam Steel Ltd. or equal.

.2 Structural steel: to CSA G40.21-98 and CSA S136-94.

.3 Welding materials: to CSA W59-1989.

.4 Shop paint primer: to EcoLogo Certified Type 1 - Water borne: Low VOCs; and not be manufactured or formulated with aromatic solvents in excess of 8% by weight.

.5 Shop paint primer: to CAN/CGSB-1.40-M89.

2.2 Fabrication

.1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA-S16.1-94 CSA S136-94 and in accordance with approved shop drawings.

.2 Weld in accordance with CSA W59-1989 and with CSA W59-1989.

2.2 Fabrication (Cont'd)

.3 Provide diagonal and horizontal bridgings and anchorages as required.

2.3 Shop Painting

.1 Clean, prepare and shop prime all surfaces of steel joists to CAN/CSA-S16.1-94 CAN/CGSB-85.100-93.

.2 Clean all members of loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces in accordance with SSPC SP 1 brush blast.

.3 Apply one coat of CISC/CMPA-2 primer to all steel surfaces to achieve maximum dry film thickness of .065 mm to .080 mm except:
.1 Surfaces to be encased in concrete.
.2 Surfaces to receive field installed stud shear connectors and steel decks.
.3 Surfaces and edges to be field welded.
.4 Faying surfaces of friction-type connections.
.5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5°C.

.5 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.

.6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 General

.1 Structural steel work: in accordance with CAN/CSA-S16.1-94 and CSA S136-94.

.2 Welding: in accordance with CSA W59-1989.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1-92 for fusion welding and/or CSA W55.3-1965 for resistance welding.

.4 Provide certification that all welded joints are qualified by Canadian Welding Bureau.

3.2 Connection to Existing Work

.1 Verify dimensions and condition of existing work; report any discrepancy and potential problem areas to Consultant for direction before commencing fabrication.

3.3 Field Quality Control

.1 Inspection and testing of materials and workmanship may be carried out by testing laboratory designated by Consultant.

.2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Consultant will determine extent of and identify all inspections.

.3 Submit test report to Consultant within 5 days after completion of inspection.

.4 Owner will pay costs of tests as specified in Section 01410 - Testing Laboratory Services.

3.4 Erection

.1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16.1-94 and in accordance with approved erection drawings.

3.4 Erection (Cont'd)

.2 Complete installation of all bridging and anchorages before placing construction loads on joists.

.3 Field cutting or altering joists or bridging : to approval of Consultant.

.4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.5 Field Painting

.1 Paint: in accordance with Section 09911 - Interior Painting.

.2 Touch up all damaged surfaces and surfaces without shop coat with CAN/CGSB-1.40-M89 in accordance with manufacturers' recommendations to CGSB 85-GP-14M.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 09911 - Painting.

.2 Section 05121 - Structural Steel for Buildings

.3 Section 05210 - Steel Joists.

1.2 References

.1 Canadian Standards Association (CSA).
.1 CSA C22.2-94. 79-1978 , Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
.2 CAN/CSA-S16.1-94 94 , Limit States Design of Steel Structures.
.3 CSA S136-94 94, Cold Formed Steel Structural Members.
.4 CSA 55.3-1965 , Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
.5 CSA W59-1989 M1989, Welded Steel Construction, (Metal Arc Welding) Metric .

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.181-92 92, Ready-Mixed Organic Zinc-Rich Coating.

.3 American Society for Testing and Materials (ASTM).
.1 ASTM A 653/A653M-97 653M-95 , Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 Canadianian Sheet Steel Building Institute (CSSI).
.1 CSSBI 10M- 96, Standard for Steel Roof Deck

1.3 Design Requirements

.1 Design steel deck using limit states design in accordance with CSA S136-94 and , CSSBI 10M and CSSBI 12M.

.2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.

.3 Deflection under specified live load not to exceed 1/240 of span, except that when plaster gypsum board ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.

.4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.1-94, Appendix'G'.

1.4 Shop Drawings

.1 Submit shop drawings erection and shoring drawings in accordance with Section 01300 - Submittals.

.2 Submit design calculations if requested by Consultant.

.3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

PART 2 - PRODUCTS

2.1 Materials

.1 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.

.2 Zinc (Z) coated steel sheet: to ASTM A 653/A653M-97 structural quality Grade 255 , with ZF75, coating,regular spangle extra smooth surface, not chemically treated for paint finish,, 0.76 mm minimum base steel thickness.

.3 Acoustic insulation: fibrous glass 17.5 kg/m n density profiled to suit deck flutes.

.4 Closures: in accordance with manufacturer's recommendations.

.5 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.6 Primer: zinc rich, ready mix to CAN/CGSB-1.181-92.

2.2 Types of Decking

.1 Steel roof deck: 0.76 mm minimum base steel thickness, 76 mm maximum deep profile.

.2 Acoustic steel roof deck: 0.76 mm minimum base steel thickness, 76 mm maximum deep profile, non-cellular, perforated on vertical face of flutes, interlocking side laps. Flat sheet for cellular deck, 0.76 mm minimum base steel thickness.

.3 Composite steel roof deck: 0.76 mm minimum base steel thickness, 76 mm deep profile, non-cellular, upright inverted embossed fluted profile, interlocking side laps. Flat sheet for cellular deck, 0.76 mm minimum base steel thickness.

2.2 Types of Decking (Cont'd)

.4 Cellular roof deck for electrical raceway: to CSA C22.2-94. 79-1978.

PART 3 - EXECUTION

3.1 General

.1 Structural steel work: in accordance with CSA S136-94 and CSSBI 10M and CSSBI 12M.

.2 Welding: in accordance with CSA W59-1989, except where specified otherwise.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1-92 for fusion welding of steel and/or CSA W55.3-1965 for resistance welding.

3.2 Erection

.1 Erect steel deck as indicated and in accordance with CSA S136-94 CSSBI 10M and CSSBI 12M and in accordance with approved reviewed erection drawings.

.2 Butt ends: to 1.5 to 3 mm gap. Install steel cover plates or over gaps wider than 3 mm.

.3 Lap ends: to 50 mm minimum.

.4 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

.5 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mil scale and other foreign matter.

.6 Place and support reinforcing steel as indicated.

3.3 Closures

.1 Install closures in accordance with approved details.

3.4 Openings and Areas of Concentrated Loads

.1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.

.2 Frame deck openings with any one dimension between 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.

.3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 Connections

.1 Install connections in accordance with CSSBI recommendations as indicated.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 03300 Cast-in-Place Concrete: Installation of anchors.

.2 Section 05121 Structural Steel.

.3 Section 05210 Steel Joists.

.4 Section 09911 Interior Painting.

.5 Section 13126 Prefabricated Buildings.

1.2 References

.1 ASTM A 307-97, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.

.3 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.

.4 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.5 CSA G40.21-98, Structural Quality Steels.

.6 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

.7 CAN/CSA-S16.1-94, Limit States Design of Steel Structures.

.8 CSA W59-1989, Welded Steel Construction (Metal Arc Welding).

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 1300.

1.3 Shop Drawings (Cont'd)

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 Protection

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

PART 2 - PRODUCTS

2.1 Materials

.1 Steel sections and plates: to CSA G40.21-98, Grade 350W steel sections and 300W steel plates.

.2 Welding materials: to CSA W59-1989.

.3 Welding electrodes: to CSA W48 Series.

.4 Bolts and anchorbolts: to ASTM A 325M-97.

.5 Aluminum sheet: proprietary utility sheet plain embossed pattern, mm minimum thickness, finish, colour.

.6 Stainless steel tubing: to ASTM A 269-96el, Type 302 Commercial grade Seamless welded with AISI No 4 finish.

.7 Grout: non-shrink, non-metallic, flowable, 24h compressive strength of MPa 15, pull-out strength 7.9 MPa.

2.2 Fabrication

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat round oval headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 Finishes

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164-M92.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: to CAN/CGSB-1.40-M89.

.4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181-92.

.5 Bituminous paint: to CAN/CGSB-1.108-M89.

2.4 Isolation Coating

.1 Isolate aluminum from following components, by means of bituminous paint:
.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
.2 Concrete, mortar and masonry.
.3 Wood.

2.5 Shop Painting

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

2.5 Shop Painting (Cont'd)

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.

.3 Clean surfaces to be field welded; do not paint.

2.6 Pipe Railings

.1 Steel pipe: mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Galvanize exterior pipe railings after fabrication. Shop coat prime interior railings after fabrication..

PART 3 - EXECUTION

3.1 Erection

.1 Do welding work in accordance with CSA W59-1989 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Engineer Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1-94, or weld.

.7 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

END

PART 1 - GENERAL

1.1 Related Work	.1	Finish Carpentry:	Section 06200
	.2	Board Insulation:	Section 07212
	.3	Batt and Blanket Insulation	Section 07213
	.4	Metal Flashings & Trims	Section 07620
	.5	Sealants:	Section 07900

1.2 Source Quality Control	.1	Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
	.2	Plywood identification: by grade mark in accordance with applicable CSA standards.

1.3 Product Handling	.1	Store materials on site so as to prevent deterioration, loss, or any impairment of the structural and other essential properties. Prevent excessive moisture gain of materials.

PART 2 - PRODUCTS

2.1 Lumber Material	.1	Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards: .1 CSA 0141-1970. .2 NLGA Standard Grading Rules for Canadian Lumber, 1987 edition.
	.2	Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers: .1 Board sizes: "Standard" or better grade. .2 Dimension sizes: "Standard" light framing or better grade.

2.1 Lumber Material (Cont'd)

.2 (Cont'd)
.3 Post and timbers sizes: "Standard" or better grade.

.3 Pressure Treated Fir Timbers: to CSA 080-M1983 and CSA 080.15-M.

2.2 Panel Materials

.1 Douglas fir plywood (DFP): to CSA 0121-M1978, standard construction.

.2 Canadian softwood plywood (CSP): to CSA 0151-M1978, standard construction.

.3 Plywood:
.1 Below Grade sheathing: Douglas Fir CSA 0121-M1978 unsanded grade sheathing, 19mm pressure treated unless otherwise indicated.
.2 Fire Retardant Treated Plywood: kiln dried to a moisture content of 15% or less. UL listed FR_S Lumber, 15P3 in accordance with AWPA C-20 Interior Type A. Acceptable material, Dricon FRTW as distributed by Hickson Timber Production, Mississauga, Ontario, ph: 905-826-9648.

2.3 Fasteners

.1 Nails, spikes and staples: to CSA B111-1974.

.2 Bolts: as indicated complete with nuts and washers, to ASTM A307.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.4 Galvanizing: to CSA G164-M1981, use galvanized fasteners for exterior work, interior highly humid areas and pressure-preservative treated lumber.

.5 Miscellaneous steel: Straps and plates to CAN/CSA - G40.21, Grade 350 W.

2.4 Wood Preservative

.1 Surface-applied wood preservative: coloured, copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pressure preservative treat components noted on the Drawings to be so treated.
.1 Treat components in accordance with CSA 080-M1983 and CSA 080.15-M.

PART 3 - EXECUTION

3.1 Furring and Blocking

.1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, plumbing fixtures and other work as required and as noted on drawings.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.2 Nailing Strips, Grounds and Rough Bucks

.1 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

3.3 Cants, Curbs, Fascia Backing

.1 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using fasteners suited and finished to the purpose.

3.4 Sleepers

.1 Pressure preservative treated installed as indicated on drawings.

.2 Field apply preservative to timbers cut in the field.

3.5 Fasteners

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

3.6 Panel-Type Subflooring

.1 Subflooring to be Douglas plywood. Size as indicated on drawings.

.2 Install subflooring with panel-end joints located on solid bearing, staggered at least 800 mm fastened utilizing screws.

.3 In addition to mechanical fasteners, apply subflooring adhesive under panels installed on wood joists. Place continuous adhesive bead in accordance with manufacturers instructions, single bead on each joist and double bead on joists where panel ends butt.

3.7 Surface-Applied Wood Preservative

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Re-treat surfaces of pressure-treated material exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as follows:

.1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck and on all surfaces in contact with concrete.

3.8 Electrical Equipment Backboard	.1	Provide backboards for mounting electrical equipment where indicated. Use 3/4" thick plywood on 3/4" x 1 1/2" furring around spacing. perimeter and at maximum 12" intermediate.

END

PART 1 - GENERAL

1.1 Related Work

.1 Comply with requirements of Division 1.

.2 Rough Carpentry Section 06100

.3 Board insulation Section 07212

.4 Metal Flashing and Trim: Section 07620

1.2 Product Delivery, Storage and Handling

.1 Deliver weather barrier materials in factory sealed rolls with labels indicating.

.1 Manufacturer or trade name.
.2 Compliance with CGSB standard.
.3 Material type, thickness, roll width and area.

.2 Protect materials from direct exposure to sunlight and physical damage.

1.3 Coordination

.1 Coordinate installation of the plywood air barrier and the polyethylene sheet vapour barrier with work of other Sections to achieve an air-vapour tight building envelope.

1.4 Quality Assurance

.1 Allow 7 days for inspection of complete work by the Architect before proceeding with covering materials. Do not cover any area until installation has been inspected and accepted by the Architect.

PART 2 - PRODUCTS

2.1 Wall Vapour Barrier

.1 Polyethylene film: to CAN2-52.33-M80, Type 1, 0.25 mm thick (10 mil)

2.2 Weather Barrier

.1 Weather Barrier: spunbonded olefin manufactured from very fine continuous filaments of high-density polyethylene (HDPE) bonded together by heat and pressure .
.1 Moisture Vapour Transmission: 3300 to ASTM E-96.
.2 Flamability: Flame Spread and Smoke Developed Value to be Class A to ASTM E-84-89a.
.3 Standard of Acceptance: "Tyvek" by Dupont Canada, 15 mm mil thick.

.2 Weather barrier tape: as recommended by weather barrier manufacturer min. 50 mm wide.

2.3 Accessories

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, self-adhesive, polyethylene, 50 mm wide for lap joints and perimeter seals.

.2 Sealant: Type 4 non-skinning, non-drying acoustical sealant in accordance with CAN/CGSB-19.22-M87. Acceptable product - Tremco Acoustical sealant.

.3 Staples: minimum 12 mm leg, Galvanized, to CSA B111-1974 nails to have large heads.

PART 3 - EXECUTION

3.1 Installation

.1 Install .25mm sheet vapour barrier on warm side of exterior wall plywood as indicated on the drawings , properly sealed at all joints, fastenings and penetrations to form continuous barrier. Coordinate installation with work of Section 06100.

.2 Use sheets of largest practical size to minimize joints.

.3 Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.

.4 Install bituminous membrane at all changes of plane, tops of walls to roof, walls to floors, roofs to walls steel support angles and where noted on drawings. All laps not less than 150mm.

3.2 Exterior Surface Openings

.1 Cut sheet vapour barrier to form openings and ensure material is lapped and sealed to solid backing at all penetrations. All penetrations must be approved by the Architect.

3.3 Perimeter Seals

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 Lap Joint Seals

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum of 400 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 Weather Barrier

.1 Install weather barrier at exterior walls where indicated on Drawings.

.2 Installed weather barrier shall be continuous and complete, lapped and taped at all joints, so as to form an effective barrier against weather, dust and snow.

END

PART 1 - GENERAL

1.1 Related Work .1 Division 3: Concrete

1.2 Product Handling .1 Deliver insulation to site in sealed wrappings bearing manufacturer's name, product name and insulation R-value or K-factor.

.2 Store materials in a dry area, protected from the elements.

1.3 Protection .1 Temporarily protect installed insulation from damage and action of the elements until it is permanently concealed or protected.

.2 Protect insulation from direct sunlight.

.3 Store adhesive at temperature of 18 deg C for at least 24 hours immediately before using.

.4 In areas where insulation is to be bonded, maintain ambient temperature at minimum 13 deg C for 48 hours before, during and after installation.

PART 2 - PRODUCTS

2.1 Below Grade Insulation .1 Polystyrene Insulation: to Can/CGSB-51-20-M87 (Type 4), RSI 1.32 (R7)per inch.
.1 Standard of Accpetance: Styrofoam HI-40 by Dow Chemicals.

2.2 Accessories .1 Spray foam insulation to: spray polyurethane to CGSB 51.23-92, Class 1. Primers: in accordance with manufacturers recommendations for surface conditions.

PART 3 - EXECUTION

3.1 Workmanship

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm heat emitting devices such as recessed light fixtures, and minimum 50 mm sidewalls of CAN/ULC-S604-1991 type A chimneys and CAN/CGA-B149.1-M95 and CAN/CGA-B149.2-M95 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Engineer.

3.2 Rigid Insulation Installation

.1 Apply adhesive to insulation board by spot application in accordance with manufacturer's recommendations, where required for temporary or permanent securement.

.2 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide .25 mm polyethylene strip over expansion and control joints using compatible adhesive before application of insulation.

3.2 Rigid Insulation Installation (Cont'd)	.3	Butt insulation boards tightly together. Leave no gaps.
	.4	Stagger joints between successive layers min. 600 mm.
3.3 Spray Foam Insulation	.1	Install around doors in exterior walls.
	.2	Seal miscellaneous locations where other specified insulations are not appropriate or adaptable.

END

PART 1 - GENERAL

1.1 Related Work	.1	Sheet Vapour Barrier:	Section 07190
	.2	Steel Building System:	Section 13125
	.3	Insulation for Mechanical Work:	Division 15

1.2 Product Handling	.1	Deliver insulation to site in sealed wrappings bearing manfacturer's name, product name and insulation R-valve or K-factor.
	.2	Store materials in a dry area, protected from the elements.

1.3 Protection	.1	Temporarily protect installed insulation from damage and action of the elements until it is permanently concealed or protected.

PART 2 - PRODUCTS

2.1 Insulation	.1	Batt and blanket mineral fibre: to CSA A101, M-1983 Type 1, thickness as indicated to achieve RSI valves indicated or to fill void.

PART 3 - EXECUTION

3.1 Insulation Installation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Install after building substrate materials are dry.

.3 Install insulation with vapour barrier facing warm side of building spaces and vapour permeable membrane facing cold side. Lap ends and side flanges of membrane over framing members. Retain in position with insulation clips installed as recommended by manufacturer.

.4 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.5 Do not compress insulation to fit into spaces.

.6 Keep insulation from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls.

.7 Do not enclose insulation until it has been inspected and approved by Architect.

END

PART 1 - GENERAL

1.1 References

.1 CGSB 51.23-92 Thermal Insulation, Urethane, Spray in Place.

.2 CGSB 51-39-92 The Installation of Spray Foam-in-Situ Urethane Insulation for Residential Building Construction.

.3 CGSB 51-GP-46MP-80 Manual for: Installers of Spray Urethane Foam Thermal Insulation.

1.2 Protection

.1 Ventilate area in accordance with Section 01500 - Temporary Facilities.

.2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.4 Protect workers as recommended by insulation manufacturer.

.5 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.6 Dispose of waste foam daily in location designated by Engineer and decontaminate empty drums in accordance with foam manufacturer's instructions.

1.3 Environmental Requirements

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturers'prescribed limits.

PART 2 - PRODUCTS

2.1 Materials

.1 Insulation: spray polyurethane to CGSB 51-GP-23M, Class 1.

.2 Primers: in accordance with manufacturers recommendations for surface conditions.

PART 3 - EXECUTION

3.1 Application

.1 Apply insulation to clean surfaces in accordance with CGSB 51-GP-39M and manufacturer's printed instructions. Use primer where recommended by manufacturer.

.2 Apply sprayed foam insulation in thickness as indicated.

END

PART 1 - GENERAL

1.1 Related Work

.1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 15 and 16 respectively.

1.2 Samples

.1 Submit samples in accordance with Section 01300 Submittals.

.2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.3 Manufacturer's Product Data

.1 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

PART 2 - PRODUCTS

2.1 Materials

.1 Fire stopping and smoke seal systems: in accordance with CAN4-S115-M85.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115-M85 and not to exceed opening sizes for which they are intended.

.2 Firestop system ratings: 1 (one) hour, 2(two) hour.

.2 Service penetration assemblies: certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.

.3 Service penetration firestop components: certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40

2.1 Materials (Cont'd)

.3 (Cont'd) U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 Preparation

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interuption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 Installation

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 Inspection

.1 Notify the Architect when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 Schedule

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated gypsum board partitions and walls.

.2 Top of fire-resistance rated gypsum board partitions.

.3 Intersection of fire-resistance rated gypsum board partitions.

.4 Control and sway joints in fire-resistance rated gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floors and ceilings.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.9 At building expansion joints in floors and roof.

3.5 Clean Up

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END

PART 1 - GENERAL

1.1 Related Work	.1	Rough Carpentry	Section 06100
	.2	Painting:	Section 09900
	.3	Steel Building Systems	Section 13126

1.2 References	.1	CGSB 93-GP-3M-78 Sheet, Steel, Galvanized, Prefinished.
1.3 Samples	.1	Submit 50 x 50 mm samples of each type of sheet metal material, colour and finish.

PART 2 - PRODUCTS

2.1 Prefinished Steel Sheet	.1	Finish: Dofasco 5000 series, factory applied coating to CGSB 93-GP- 3M.Minimum of two colors will be selected from the manufacturers standard selection.
	.2	Base metal 0.61 mm sheet steel. Thickness for prefinished steel sheet applies to base metal.
2.2 Accessories	.1	Isolation coating: alkali resistant bituminous paint.
	.2	Plastic cement: to CGSB 37-GP-5Ma.
	.3	Sealants: to CGSB 19-GP-9Ma one component silicone base chemical curing; colour to match the material on which they occur.
	.4	Cleats:Galvanized sheet steel to ASTM 446 Grade A, G90; minimum thickness .9 mm, minimum 50 mm wide.

2.2 Accessories (Cont'd)

.5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Touch-up paint: as recommended by metal flashing and trim manufacture.

2.3 Fabrication

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series specifications.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints. Provide flat locked seams, lapped 25 mm.

.3 Hem exposed edges on underside 12 mm. Miter and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Where less than 2400 mm long, provide single length of flashing.

2.4 Metal Flashings

.1 Form flashings, copings and fascias to profiles indicated of 0.61 mm thick prefinished steel.

PART 3 - EXECUTION

3.1 Installation

.1 Clean substrates of dirt and other foreign matter. Drive projecting nails flush with substrate. Do not apply metal flashings over substrates likely to cause rupture.

.2 Install metal flashings at eaves, rakes, junction of roofs and higher walls, penetrations through roofs, door and window heads, and where shown on drawings.

3.1 Installation (Cont'd)

.3 Metal roof edge flashings to be S-locked and sealed with sealant at flashing face. Flashing cleats shall be installed at the rate of 2 per 2.5 m of flashing length.

.4 Sleeve Flashing System:

.1 At air intake ducts and other mechanical penetrations not specifically covered under Division 15, provide sleeve flashing system.

.2 Prior to installation of roofing place bead of sealant around penetration. Place bitumen protection cup and sleeve over penetration into sealant.

.3 Insulate between penetration cup and sleeve with 25 mm thick fibrous insulation.

.4 Prime surfaces to receive base sheet.

.5 Install metal collar.

.5 At wall openings extend flashing up behind insulating sheathing min. 100 mm and form a drip at the outside edge. Nail along top edge of flashing to supporting building elements.

.6 Where flashing are exposed, provide cleats or locking strips to secure them. Do not use exposed fasteners, unless approved by the Architect.

.7 Fill and seal seams with sealant in accordance with Section 07900.

.8 Install plumbing vent flashings bedded in S.B.S. mastic over base sheet with nails or flat head screws @ 75 mm o.c. in two staggered rows.

END

PART 1 - GENERAL

1.1 Summary

.1 This Section specifies caulking and sealants not specified in other Sections.

.2 Refer to other sections for other caulking and sealants.

1.2 References

.1 CAN 2-19.13.M82, Sealing Compound one component moisture curing.

.2 CAN/CGSB-19.18-M87 Sealing Compound, One Component, Silicone Base, Solvent Curing.

.3 CAN/CGSB-19.13-M87 Sealing Compound, One-component, Elastomeric, Chemical Curing.

.4 CAN/CGSB 19-22-M89 Sealing Compound Mildew Resistant, for Tubs and Tile.

1.3 Delivery, Storage, and Handling

.1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture and water.

1.4 Environmental and Safety Requirements

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 Sealant Materials

.1 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

.1 Sealant Type 1: silicone base, one part moisture curing sealant to CAN 2-19.13-M82. colour to be selected: to be used with joint back-up bond breaker and primer. Acceptable product Dow Corning 790.

.2 Sealant Type 2: silicone base, one part mildew and fungus resistant, to CGSB 19-GP-22M-77. Acceptable product Dow Corning 786 mildew resistant sealant.

.3 Sealant Type 3: Silicone base, one component to CAN/CGSB-19.22M-87 acoustic sealant and bedding compound. Acceptable product Tremco acoustic sealant.

.4 Colours to be selected from the standard manufacturer's range.

2.2 Back-up Materials

.1 Joint Back-Up:

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam:

.1 Extruded closed cell foam backer rod.

.2 Size: oversize 30 to 50%.

.2 High Density Foam:

.1 Extruded tubing closed cell polyvinyl chloride (PVC) or neoprene foam backer, 6 mm thick wall, outsize 30-50% size as recommended by manufacturer.

.3 Bond Breaker Tape

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 Joint Cleaner

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

PART 3 - EXECUTION

3.1 Preparation of Joint Surfaces

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants: joint depth to half the joint width min. 5 mm to max. 25 mm.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.2 Priming

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.3 Backup Material

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape.

3.4 Mixing

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.5 Application

.1 Sealant.

.1 Apply sealant in accordance with manufacturer's instructions.

.2 Apply sealant in continuous beads.

.3 Apply sealant using gun with proper size nozzle.

.4 Use sufficient pressure to fill voids and joints solid.

.5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.6 Tool exposed surfaces to give slightly concave shape.

.7 Remove excess compound promptly as work progresses and upon completion.

.2 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup.

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

3.6 Schedule

.1 Sealant Type 1: Exterior use around door frames, and mechanical & electrical penetrations, exterior joints between dissimilar materials.

.2 Sealant Type 2: Interior use generally as the building is of high humidity levels and requires mildew and fungas resistance.

.3 Sealant Type3: As directed in Section 09250.

END

PART 1 - GENERAL

1.1 Related Work	.1	Rough Carpentry:	Section 06100
	.2	Sealants	Section 07900
	.3	Finish Hardware:	Section 08710
	.4	Interior Painting:	Section 09911
	.5	Exterior Painting:	Section 09912
	.6	Electrical:	Division 16

1.2 References

.1 Canadian Standards Association (CSA).
.1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
.2 CSA G40.21-M92, Structural Quality Steels.
.3 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.
.2 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
.3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.4 CGSB 51-GP-21M, Thermal Insulation, Urethane and Isocyanurate, Unfaced.

.3 American Society for Testing and Materials (ASTM).
.1 ASTM A 525M-91b, Specification for General Requirements for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process Metric.
.2 ASTM A 526/A 526M-90, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
.3 ASTM E 152-81a, Methods for Fire Tests of Door Assemblies.

1.2 References (Cont'd)

.4 Underwriters' Laboratories of Canada (ULC).
.1 CAN4-S104-M80(R1985), Fire Tests of Door Assemblies.
.2 CAN4-S105-M85(R1992), Fire Door Frames.

.5 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA).
.1 CSDFMA, Specifications for Commercial Steel Doors and Frames, 1990.
.2 CSDFMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.

.6 National Fire Protection Association (NFPA).
.1 ANSI/NFPA 80-1995, Fire Doors and Windows.
.2 ANSI/NFPA 252-1995, Door Assemblies Fire Tests of.

1.3 Design Requirements

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 -Submittals.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 Requirements of Regulatoryand liste Agencies

.1 Steel fire rated doors and frames: labelled d by an organization accredited by Standards Council of Canada in conformance with CAN4-S104-M80(R1985) 252 for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104-M80(R1985), ASTM E 152-81a or ANSI/NFPA 252-1995 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 Product Handling

.1 Tag doors and frames at shop with ID marks to indicate proper location.

.2 Package, deliver, store and handle components so as to prevent damage distortions and corrosion. Frames bent in shipping will be rejected. Store components off the ground and under cover in a dry protected area. Stack doors to prevent twisting. Do not enclose components in plastic covers without venting.

PART 2 - PRODUCTS

2.1 Materials

.1 Galvanized steel sheet: commercial quality to ASTM A 526/A 526M-90, with zinc coating designation Z275 for exterior doors and frames and ZF075 for interior doors and frames as per ASTM A 525-93.

.2 Doors:

.1 For interior doors 1.6 mm (16 gauge) base thickness.

.2 For exterior doors 1.6 mm (16 gauge) base thickness.

2.1 Materials (Cont'd)

.3 Door Core:
.1 Interior Doors: Honeycomb core consisting of kraft paper having 20 mm cell size to thickness indicated.
.2 Exterior Doors: Bonded core: urethane or isocyanurate board insulation to CGSB 51-GP-21M, bonded to door skins, with no metal to metal contact except at edges.

.4 Frames:
.1 Steel frames to exterior 1.6 mm base thickness.
.2 Steel frames interior 1.2 mm base thickness.
.3 Strike bucket of not thinner that 0.5mm steel shall be provided. Frames should be fabricated with bucket/box to accommodate door contacts.

.5 Provide other door and frame components in accordance with CSDFMA requirements.

.6 Primer:
.1 For galvanized steel sheet: CAN/CGSB-1.181-92

.7 Door Bumpers: single stud neoprene type.

.8 Glazing stops: 1.0 mm steel, 16 x 16 mm channel accurately fitted, butted at corners and fastened to frame sections with countersunk oval head sheet metal screws.

.9 Make provisions for glazing as indicated and provide necessary glazing stops.
.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
.2 Design exterior glazing stops to be tamperproof.

.10 Metallic paste filler: to manufacturer's standard.

.11 Fire labels: metal rivited.

2.2 Fabrication

.1 Fabricate doors and frames as detailed, to Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA) Canadian Manufacturing Specifications for Steel Doors and Frames, 1982; except where specified otherwise. Reinforce door and frames to suit hardware requirements as follows and continuously as described in 2.1.8 for:

.1 Hinge & pivot reinforcements.
.2 Strike reinforcements:
.3 Flush bolt reinforcements:
.4 Closer Reinforcements:
.5 Surface hardware reinforcements:

.2 On exterior door frames, hinge, pivot and closer reinforcement to be continuous angle as detailed on the drawings. Blank, reinforce, drill and tap doors and frames for mortised hardware. Reinforce doors and frames for surface mounted hardware.

.3 Shop prime cold rolled steel sheet.

.4 Apply, at factory, touch up primer to doors and frames manufactured from galvanized steel where coating has been removed during fabrication.

2.3 Frames Fabrication General

.1 Fabricate frames in accordance with CSDFMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded, thermally broken type construction.

.4 Interior frames: 1.2 mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

2.3 Frames Fabrication General (Cont'd)	.6	Protect mortised cutouts with steel guard boxes.
	.7	Prepare frame for door silencers, 3 for single door, 2 at head for double door.
	.8	Manufacturer's nameplates on frames and screens are not permitted.
	.9	Conceal fastenings except where exposed fastenings are indicated.
	.10	Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
	.11	Insulate exterior frame components with polyurethane insulation.
2.4 Frame Anchorage	.1	Provide appropriate anchorage to floor and wall construction.
	.2	Locate each wall anchor immediately above or below each hinge reinforecement on hinge jamb and directly opposite on strike jamb.
	.3	Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
2.5 Frames: Welded Type	.1	Welding in accordance with CSA W59-1989.
	.2	Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
	.3	Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
	.4	Grind welded joints and corners to a flat plane, fill with metalic paste and sane to uniform smooth finish.

2.5 Frames: Welded Type (Cont'd)

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.6 Door Fabrication General

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: honeycomb construction. Interior doors: hollow steel construction.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware.

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Fabricate exterior doors with flush closure channel top and weep holes in bottom channel.

.9 Profile door edges as follows: single acting swing doors bevel 3 mm in 50 mm; double acting swing doors radius of 54 mm.

.10 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

2.6 Door Fabrication General (Cont'd)

.11 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104-M80(R1985), ASTM E 152-81a or ANSI/NFPA 252-1995 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.12 Manufacturer's nameplates on doors are not permitted.

2.7 Doors: Honeycomb Core Construction

.1 Form each face sheet for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

.2 Form each face sheet for interior doors from 1.2 mm sheet steel with honeycombcore laminated under pressure to face sheets.

2.8 Thermally Broken Doors and Frames

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

.5 **Standardo f Acceptance:f or ThermallyB roken Frames:F lemmingD oors&F ramesu nless otherwisea cceptedi nw ritingb yt he consultant.**

PART 3 - EXECUTION

3.1 Installation General

.1 Install labelled steel fire rated doors and frames to ANSI/NFPA 80-1995 except where specified otherwise.

.2 Install doors and frames to CSDFMA Installation Guide.

3.2 Frame Installation

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continunity of Weather Barrier and Air/Vapour Barrier.

3.3 Door Installation

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08710 - Door Hardware.

3.3 Door Installation (Cont'd)

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor, top of carpet noncombustible sill and thresholds: 13 mm.

.3 Maximum permissible warp of 3 mm measured diagonally across door.

.4 Adjust operable parts for correct function.

3.4 Finish Repairs

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 Glazing

.1 Install glazing for doors and frames in accordance with Section 08800 - Glazing.

END

1. General

1.1. Work Included

1.1.1. In Accordance with the General Requirements stated in Division 1, supply Finish Hardware as listed in the Hardware Schedule.

1.2. Related Work

Cabinet Hardware	Section 06200 Section 06400
Metal Door & Frames	Section 08111
Miscellaneous Specialties	Section 10999

1.3. Quality Assurance

1.3.1. Product Qualification
Products listed in the Hardware Schedule have been selected to achieve a minimum standard based upon Quality, Design and Finish.

1.3.2. Equals
Requests for equals shall be done in writing complete with two (2) sets of catalogues and, if requested, samples of each product. Submissions shall be made in accordance with the requests for substitutions outlined in Section 1 "Tender Submissions".

1.3.3. Supplier Qualifications
Finish Hardware suppliers shall be well established in this field with adequate equipment, maintenance and advisory facilities in order to service and keep pace with contract obligations and responsibilities. Supplier's Coordinator should be well-versed in applications, functions, and concepts of Mechanical or Electrical Door Hardware able to provide technical assistance when required. (Accredited Architectural Hardware Consultant AHC Preferred)

1.4. Reference Standards

NBC National Building Code
NFPA 80 Fire Doors and Windows
NFPA 101 Life Safety Code
NFPA 105 Smoke and Draft Control
CAN/CSA-B651 Barrier Free Design Code
U.L.C. Underwriters Laboratories of Canada
C.S.A. Canadian Standards Association
B.H.M.A. Builders Hardware Manufacturers Association
D.H.I. Doors and Hardware Institute

1.5. Submittals

1.5.1. Submit all Shop Drawings in accordance with the Contract Documents.

1.5.2. Submit six (6) copies of the Hardware Schedule listing the sizes, types, quantities, door numbers and locations, swings, degree of opening and all preparation of the doors and frames.

1.5.3. Upon receipt of the approved Hardware Schedule, submit complete sets of related templates to all effected parties for door and frame manufacturing.

1.5.4. Submit two (2) copies of catalogue cuts and literature describing each product of hardware with original submittal of hardware shop drawings.

1.5.5. Submit two (2) copies of the Keying Schedule after reviewing with the Architect/Owner.

1.6. Packaging, Labeling and Delivery

1.6.1. Packaging: Include with each item of Hardware the following
a. Screws, Bolts and Fasteners necessary for installation
b. Installation instructions
c. Special Tools required for installation

1.6.2. Labeling and Delivery: Deliver each item of hardware wrapped separately in a manner to prevent damage to finish or surfaces. Products delivered to site shall be clearly and legibly labeled to the item number, and if possible, door numbers as listed in the approved hardware shop drawings.

1.6.3. Storage: Space should be clean, dry, suitably lighted and secure under lock and key, accessible to Authorized Personnel.

1.6.4. Protection: Protect knob, handles, push plates, pulls, etc., with adhesive release paper, of type that is easily removed without marring the finish.

1.7. Coordination

1.7.1. Coordinate Finish Hardware with all affected trades.

1.7.2. Hardware Supplier to be available to provide technical assistance or instructions in proper installation of all hardware.

End

1.8. Warranty

1.8.1. Provide a (1) year warranty for all hardware excluding door closers which shall have a minimum (10) year warranty.

2. Products

2.1. Product Specifications

2.1.1. Provide Finish Hardware by manufacturers specified, unless formal notification of equal product submission has been approved.

2.1.2. Unapproved alternates or substitutions will not be accepted. If any of these products are provided without receiving prior approval by the Architect/Consultant, the proper product will be replaced at nc additional cost to the owner or contractor by the Supplier.

2.1.3. All weatherstripping sets & thresholds must contain thermal plastic elastomer material (TPE) inserts with low temperature flexibility to -40°C.

2.1.4. Acceptable Manufacturers (Must match function, design, finish and application as specified products in section 4.0, desertion of the consultant. If not listed see section 1.3.2, 2.1.1, 2.1.2 for request submissions)

Continuous Hinges:
Select Products Ltd.,
Hager Hinge Company, McKinney Hinges

Standard Hinges:
Stanley Hardware, McKinney Hinge, Hager Hinge Company

Locksets:
Best

Door Closers:
Sargent, LCN, Corbin

Exit Devices:
Sargent, Von Duprin, Corbin

Flatware:
Canadian Builders Hardware (CBH), Standard Metal Mfg. Hager Hinge,

Weatherstrip:
Draftseal, National Guard Products, Pemko,
Reese Enterprises

Miscellaneous: As specified

End

2.2. Materials/Fasteners

2.2.1. Furnish all Hardware with necessary screws, bolts, etc., for the proper installation as recommended by the manufacturers' specifications.

2.2.2. Fastening devices shall be of the same finish and material as the hardware to which it is fastened.

2.2.3. Provide sex bolts/through bolts where required on U.L.C. rated assemblies.

2.2.4. Continuous Hinge installation and fastener securing to be drilled on site by installer.

2.2.5. All strike plates in exposed or high traffic areas shall be of mortise type installation, unless otherwise specified.

2.2.6. Kickplates shall be (2") 50mm less than door width on push side and (1") less than door width on the pull side and shall be fastened with self-tapping or wood screws.

2.2.7. Fasteners must also project through the weatherstripping and gasketing material to ensure proper anchoring for extreme application.

2.2.8. Refer to door schedule for proper sizing of hardware.

2.3. Finishes

2.3.1. Provide all finishes as listed in the hardware schedule.

2.4. Keying

2.4.1. All locks are to be Grandmasterkeyed to the Pangnirtung Sewage Treatment system.

Supply the Following:
(3) Grandmaster keys
(3) Master keys per sub group
(5) Construction Masterkeys
(3) Control Keys
(2) Change keys per lock or cylinder

2.4.2. Architect/Owner to advise all keying requirements.

2.5. Key Control Systems

2.5.1. Supply one (1) Steel Key Cabinet to contain all keys with provisions for 50 % expansion capacity.

2.5.2. Instruction on set up of key cabinet provided by the contractor.

End

2.5.3. Installation of key cabinet to be done by the owner.

2.5.4. Installation of keys and indexing by owner.

3. Execution

3.1. Inspection

3.1.1. Ensure before final inspection that doors and frames have been installed plumb and with tolerances stated in the D.H.I. document installation of Commercial Steel Doors and Frames".

3.1.2. Ensure all door closers have been properly adjusted to current building condition at substantial completion stage.

3.1.3. Valve Adjustments should include Backcheck, Closer Spring Tension, Closing and Latching Speed, Degree of Opening and if applicable Delayed Action.

3.2. Installation

3.2.1. Finish Hardware shall be installed by a qualified tradesman, with a minimum of 5 years experience in door, frame and hardware installation and adjustment.

3.2.2. Finish Hardware to be installed as per manufacturers instructions in accordance with D.H.I. document "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" which list all mounting heights and locations.

3.3. Adjusting and Cleaning

3.3.1. Before final inspection ensure that all hardware has been installed according to the approved hardware schedule, D.H.I. documents and manufacturers instructions, replace any hardware that is damaged, scratched or marked or incorrect operation.

3.3.2. After mechanical system has been balanced, check all door closer adjustments to ensure operation is correct. Refer to Section 3.01.2

4. Hardware Schedule

Hardware Group # 1 (Dr # 101A)

1	ea.	Continuous Hinge	MCK12HD x D.H.	C28
1	ea.	Exit Device	8943 x ETL	32D
1	ea.	Best Cylinder	1E-74 (Cam to Suit Lock)	626
1	ea.	Door Closer	351-P10	EN
1	ea.	O/H Stop	690S	26D

End

1	ea.	Kickplate	80A-254 x D.W.	32D
1	ea.	Threshold	DS701TB x D.W.	AL
1	set	Weatherstrip	DS133C 1/D.W. 2/D.H.	AL
1	ea.	Door Sweep	DS157A x D.W.	AL

Hardware Group # 2 (Dr # 101B)

2	ea.	Continuous Hinge	MCK12HD x D.H.	C28
1	ea.	Exit Device	PP8713 x ETL (RHR Door)	32D
1	ea.	Exit Device	PR8710	32D
1	ea.	Best Cylinder	1E-74 (Cam to Suit Lock)	626
2	ea.	Door Closer	351-P10	EN
2	ea.	O/H Stop	690S	26D
2	ea.	Kickplates	80A-254 x D.W.	32D
1	ea.	Threshold	DS701TB x D.W.	AL
2	sets	Weatherstrip	DS133C 1/D.W. 2/D.H.	AL
2	ea.	Door Sweep	DS157A x D.W.	AL
1	set	Astragal	DS147AS 1/D.W. 2/D.H.	AL

Hardware Group # 3 (Dr # 102A, 103A)

3	ea.	Hinges	TA314 114 x 101mm	32D
1	ea.	Office Lockset	93K7AB15K	26D
1	ea.	Door Closer	351-CPS	EN
1	ea.	Kickplate	80A-254 x D.W.	32D
1	set	Seal	DSS66D 1/D.W. 2/D.H.	BRZ

Hardware Group # 4 (Dr # 104A)

3	ea.	Hinges	TA314 114 x 101mm	32D
1	ea.	Privacy Lockset	93KL15K	26D
1	ea.	Wall Stop	233B	26D
1	ea.	Coat Hook	307	26D
1	set	Seal	DSS66D 1/D.W. 2/D.H.	BRZ

End

PART 1 - GENERAL

1.1 Related Work	.1	Rough Carpentry	Section 06100
	.2	Interior Painting	Section 09911

1.2 Reference Standards	.1	Do work in accordance with CSA A82.31-M1980 except where specified otherwise.

PART 2 - PRODUCTS

2.1 Gypsum Board	.1	Standard board: to CSA A82.27-M1977 regular, 12.7 mm thick, Type X, 15.9 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.
2.2 Metal Furring and Suspension Systems	.1	Metal furring runners, hangers, tie wires, inserts, anchors: to CSA A82.30-M1980, galvanized.
	.2	Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
	.3	Resilient: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
2.3 Fastenings and Adhesives	.1	Nails, screws and staples: to CSA A82.31-M1980.
	.2	Stud adhesive: to CGSB 71-GP-25M-77.

2.4 Accessories

.1 Casing beads, corner beads fill type: 0.5 mm base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A525-86, perforated flanges; one piece length per location.

.2 Acoustic sealant: to CAN/CGSB-19.21-M87.

.3 Joint compound: to CSA A82.31-M1980, asbestos-free.

.4 Sound attenuation batts: Batt and blanket mineral fibre: to CSA A101-M1983, Type 1A preformed with no membrane, 89mm thick or as indicated on drawings.

PART 3 - EXECUTION

3.1 Suspended and Furred Ceilings

.1 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with CSA A82.31-M1980 except where specified otherwise.

.2 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.3 Install work level to tolerance of 3 mm in 3 metres.

.4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffuses, grilles.

.5 Install furring channels parallel to, and at exact locations of steel stud partition header track.

3.2 Ceiling Bulkheads

.1 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.2 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

3.3 Wall Furring

.1 Install wall furring for gypsum board wall finishes in accordance with CSA A82.31-M1980, except where specified otherwise.

.2 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.4 Install acoustic insulation where indicated on the drawings.

3.4 Resilient Furring

.1 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm oc and not more than 150 mm from ceiling/wall junction. Secure to each support with 25 mm drywall screw.

3.5 Gypsum Board Application

.1 **Don ota pplyg ypsumb oardu ntilb ucks, anchors,b locking,e lectricala ndm echanical worka rea pproved.**

.2 Apply single layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm oc.

.3 Apply water resistant gypsum board adjacent to slop sinks in janitors closets. Apply water- resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.

3.5 Gypsum Board Application (Cont'd)

.4 Erect gypsum board vertically for walls, unless horizontal application results in fewer end joints. Locate end joints over framing members. Provide 5 mm clearance from all structural elements to accommodate accoustic sealant.

.5 Keep end joints away from prominent locations and central portions of ceilings.

.6 Locate vertical joints at least 300 mm from jamb lines of doors, windows and other openings.

.7 Erect ceiling gypsum board perpendicular to framing members.

.8 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

3.6 Accessories

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

3.7 Control Joints

.1 Construct control joints of two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint or as indicated on the drawings.

.2 Provide continuous polyethylene dust barrier behind and across control joints.

.3 Locate control joints where indicated or at approximately 10 m spacing on long corridor runs and at approximately 15 m spacing on ceilings.

.4 Install control joints straight and true.

3.8 Expansion Joints

.1 Construct expansion joints, at building expansion and construction joints. Provide continuous dust barrier.

.2 Install expansion joint straight and true.

3.9 Access Doors

.1 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.2 Rigidly secure frames to furring or framing systems.

3.10 Taping and Filling

.1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.2 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent

3.10 Taping and Filling (Cont'd)

.3 (Cont'd) surface of gypsum board so as to be invisible after surface finish is completed.

.4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

END

PART 1 - GENERAL

1.1 Related Sections

.1	Metal Fabrications:	Section 05500
.2	Metal Doors and Frames:	Section 08111
.3	Gypsum Board:	Section 09250
.4	Mechanical Division:	Division 15
.5	Electrical Division:	Division 16

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Submit full records of all products used. List each product in relation to finish formula and include the following:
- .1 Finish formula designation.
- .2 Product type and use.
- .3 CGSB number.
- .4 Manufacturer's product number.
- .5 Colour number.
- .6 Manufacturer's Material Safety Data Sheets (MSDS).
- .7 Maximum VOC classification.
- .8 Ecologo certification.

.3 Submit manufacturer's application instructions for each product specified.

1.3 Samples

.1 Submit samples in accordance with Section 01300 - Submittals.

.2 Submit full range of available colours where colour availability is restricted.

1.4 Quality Assurance

.1 Standard of Acceptance:
.1 Walls. No defects visible from a distance of 1000 mm at 90 degrees to surface.
.2 Ceilings. No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.5 Delivery Storage and Handling

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Indicate on containers or wrappings:
.1 Manufacturer's name and address.
.2 Type of paint.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7° to 30° C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Engineer. After completion of operations, return areas to clean condition to approval of Engineer.

1.5 Delivery Storage and Handling (Cont'd)

.10 Provide minimum one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.11 Remove only in quantities required for same day use.

.12 Fire Safety Requirements

.1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.6 Environmental Requirements

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.2 Ventilation:

.1 Provide continuous ventilation during and after application of paint. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of application of paint.

.3 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturers recommendations.

.4 Substrate and ambient temperature must be within limits prescribed in paint standard and by manufacturer to approval of Engineer.

.5 Maintain minimum substrate and ambient air temperature of 5° C for Alkyd and 7° C for latex paints. Maximum relative humidity 85%. Maintain supplemental heating until paint has cured sufficiently.

1.6 Environmental Requirements (Cont'd)

.6 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

.7 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

.8 Apply paint only when surface to be painted is dry, properly cured and adequately prepared.

1.7 Extra Materials

.1 Submit maintenance materials in accordance with Section 01731 - Maintenance Materials, Special Tools and Spare Parts.

.2 Submit one - four litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.3 Deliver to Engineer and store where directed.

PART 2 - PRODUCTS

2.1 Materials

.1 Qualified products: only paint materials listed on the CGSB Qualified Products List are acceptable for use on this project.

.2 Paint materials for each coating formula to be products of a single manufacturer.

.3 Low odour products. Whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour.

2.2 Colours

.1 As indicated in the Finish Schedule.

.2 Perform all colour tinting operations prior to delivery of paint to site.

.3 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Paint Finishes

.1 Formula 7 (Latex): for gypsum board, walls apply:
.1 one coat latex primer-sealer CAN/CGSB-1.119-95.
.2 two coats semigloss enamel CAN/CGSB-1.195-95.

.2 Formula 8 (Latex): for gypsum board, ceilings apply:
.1 one coat latex primer-sealer CAN/CGSB-1.119-95.
.2 two coats low gloss enamel CAN/CGSB-1.209-93.

.3 Formula 12 (alkyd): for concrete floors apply:
.1 one coat floor enamel CAN/CGSB-1.73-M91. Reduced.
.2 two coats floor enamel CAN/CGSB-1.73-M91.

.4 Formula 15 (Alkyd): for shop primed ferrous metal surfaces apply:
.1 touch up with shop primer with primer as provided by fabricator.
.2 one coat marine alkyd metal primer CGSB 1-GP-48M.
.3 two coats low gloss enamel CAN/CGSB-1.202-92.

.5 Formula 17 (Alkyd): for galvanized and zinc coated metal apply:
.1 one coat vinyl wash primer CAN/CGSB-1.121-93.
.2 two coats semigloss enamel CAN/CGSB-1.57-M90.

2.3 Paint Finishes (Cont'd)

.6 Formula 21 (Alkyd): for copper piping and fittings apply:
.1 one coat vinyl wash primer CAN/CGSB-1.121-93.
.2 two coats low gloss enamel CAN/CGSB-1.202-92.

.7 Formula 22 (Alkyd): for cotton or canvas insulation coverings apply:
.1 one coat latex primer-sealer CAN/CGSB-1.119-95.
.2 two coats low gloss enamel CAN/CGSB-1.202-92.

PART 3 - EXECUTION

3.1 General

.1 Perform all painting operations in accordance with CAN/CGSB-85.100-93 except where specified otherwise.

.2 Apply all paint materials in accordance with paint manufacturers written application instructions.

3.2 Protection

.1 Protect existing building surfaces not to be painted from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Engineer.

.2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.3 Protect items that are permanently attached such as Fire Labels on doors and frames.

.4 Protect factory finished products and equipment.

.5 Protect passing pedestrians, and the general public in and about the building.

3.3 Cleaning

.1 Clean all surfaces to be painted as follows:
.1 Remove all dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
.2 Wash surfaces with solution of T.S.P. bleach and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
.4 Allow surfaces to drain completely and allow to dry thoroughly.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

3.4 Surface Preparation

.1 Prepare concrete floors to CGSB 85-GP-32M. Prepare new concrete floor by acid etching. Rinse with clean water and thoroughly dry.

.2 Prepare plaster and wallboard surfaces to CGSB 85-GP-33M.

3.5 Surface Preparation -removing Metal

.1 Clean new metal surfaces to be painted by: rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with the following:
.1 Solvent cleaning: SSPC-SP-1.
.2 Hand tool cleaning: SSPC-SP-2.
.3 Power tool cleaning: SSPC-SP-3.

.2 Touch up shop primer to CGSB 85-GP-10M with primer as specified in applicable section. Touch-up to include cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas.

3.5 Surface Preparation -steel sur Metal (Cont'd)

.3 Prepare galvanized steel and zinc coated faces to CGSB 85-GP-16M.

.4 Prepare copper and copper alloys surfaces to CGSB 85-GP-20M.

.5 Prepare new steel surfaces exposed normally to dry conditions to CGSB 85-GP-14M.

3.6 Application

.1 Method of application to be as approved by Engineer. Apply paint by brush roller air sprayeror airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush application.

.1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by spray, daubers or sheepskins.

.2 Brush out runs and sags.

.3 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application.

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately all runs and sags.

.5 Use branches to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

3.6 Application (Cont'd)

.5 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between each coat to remove visible defects.

3.7 Mechanical Electrical Equipment

.1 In finished areas: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment. Colour and texture to match adjacent surfaces, except as noted otherwise.

.2 In boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 In other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.7 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.8 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original

3.7 Mechanical Electrical Equipment (Cont'd)

.8 (Cont'd) finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.8 Field Quality Control

.1 Field inspection of painting operations to be carried out be independent inspection firm as designated by Engineer.

.2 Advise Engineer when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with engineer and provide access to all areas of the work.

END

PART 1 - GENERAL

1.1 Related Sections

.1	Steel Doors and Frames:	Section 08111
.2	Metal Fabrications:	Section 05500
.3	Mechanical:	Division 15
.4	Electrical:	Division 16

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Submit full records of all products used. List each product in relation to finish formula and include the following:

.1 Finish formula designation.
.2 Product type and use.
.3 CGSB number.
.4 Manufacturer's product number.
.5 Colour number.
.6 Manufacturer's Material Safety Data Sheets (MSDS).
.7 Maximum VOC classification.

.3 Submit manufacturer's application instructions for each product specified.

1.3 Quality Assurance

.1 Walls. No defects visible from a distance of 1000mm at 90 degrees to surface.

.2 Final coat to exhibit uniformity of colour and texture as well as uniformity of sheen across full surface area.

1.4 Delivery, Storage and Handling

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Indicate on containers or wrappings:
.1 Manufacturer's name and address.
.2 Type of paint.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, weatherproof, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7° to 30° C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Engineer. After completion of operations, return areas to clean condition to approval if Engineer.

.10 Provide minimum one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.11 Remove only in quantities required for same day use.

.12 Fire Safety Requirements
.1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed

1.4 Delivery, Storage and Handling (Cont'd)

.12 (Cont'd)

.1 (Cont'd)

containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.5 Environmental Requirements

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.2 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.

.3 Where surface to be painted is not under cover, do not apply paint when:

.1 Substrate and ambient air temperature is below 5° C for alkyd and 7° C for latex paints or when temperature is expected to drop to 0° C before paint has thoroughly cured.

.2 Substrate and ambient air temperature are expected to fall outside limits prescribed in paint standard and by manufacturer.

.3 Temperature of surface is over 50°C unless paint is specifically formulated for application at high temperatures.

.4 Rain or snow are forecast to occur before paint has thoroughly cured; it is foggy, misty, raining or snowing at site; relative humidity is above 85%.

.5 surface to be painted is wet, damp or frosted.

.6 Previous coat is not dry.

.4 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

1.5 Environmental Requirements (Cont'd)

.5 Apply paint finish only when dust is no longer being generated by related construction operations or when wind conditions are such that airborne particles will nct affect the quality of the finished surface.

.6 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.7 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

1.6 Extra Materials

.1 Submit maintenance materials in accordance with Section 01721 - Maintenance Materials, Special Tools and Spare Parts.

.2 Submit 1 - 4 litre can of each type and colour of primer, stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.3 Deliver to Engineer and store where directed.

PART 2 - PRODUCTS

2.1 Materials

.1 Qualified products: only paint materials listed on the CGSB Qualified Products List are acceptable for use on this project.

.2 Paint materials for each coating formula to be products of a single manufacturer.

2.2 Colours

.1 As indicated in Finish Schedule.

.2 Perform all colour tinting operations prior to delivery of paint to site.

2.2 Colours (Cont'd)

.3 Ensure each second coat in a three coat system is tinted lighter colour than top coat.

2.3 Paint Finishes

.1 Formula 14 (Alkyd): for primed ferrous metal to receive paint apply:
.1 spot priming with shop primer.
.2 one coat oil alkyd primer CAN/CGSB-1.40-M89 one coat zinc chromate primer CAN/CGSB-1.132-M90.
.3 two coats alkyd gloss enamel CAN/CGSB-1.59-M89.

.2 Formula 17 (Alkyd): for galvanized and zinc coated metal to receive paint apply:
.1 one coat cementitious primer CAN/CGSB-1.198-95.
.2 two coats alkyd gloss enamel CAN/CGSB-1.59-M89.

PART 3 - EXECUTION

3.1 General

.1 Perform all painting operations in accordance with CAN/CGSB-85.100-93.

.2 Apply all paint materials in accordance with paint manufacturers written application instructions.

3.2 Protection

.1 Protect exterior existing building surfaces not to be painted from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Engineer.

.2 Cover or mask windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.3 Protect items that are permanently attached such as Fire Labels on doors and frames.

3.2 Protection (Cont'd)

.4 Protect factory finished products and equipment.

.5 Protect passing pedestrians, and the general public in and about the building.

3.3 Cleaning

.1 Clean all surfaces to be painted as follows:
.1 Remove all dust, dirt, and other surface debris by wiping with dry, clean cloths or compressed air.
.2 Wash surfaces with solution of T.S.P. bleach and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
.4 Allow surfaces to drain completely and allow to dry thoroughly.

.2 Prevent contamination of cleaned surfaces before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

3.4 Surface Preparation -accordanc Metal

.1 Clean new metal surfaces to be painted in e with the following:
.1 Solvent cleaning: SSPC-SP-1.
.2 Hand tool cleaning: SSPC-SP-2.
.3 Power tool cleaning: SSPC-SP-3.

.2 Touch up damaged or defective paint or rusted areas shop primer to CGSB 85-GP-10M with primer as specified in applicable section.

.3 Prepare galvanized steel and zinc coated steel surfaces to CGSB 85-GP-16M.

.4 Prepare new steel surfaces exposed normally to dry conditions to CGSB 85-GP-14M.

3.5 Application

.1 Apply paint by brush, roller, air sprayer or airless sprayer as approved by Engineer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush application.

.1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by daubers or sheepskins.

.2 Brush out runs and sags.

.3 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application.

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately all runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

.5 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between each coat to remove visible defects.

3.5 Application (Cont'd)

.8 Finish tops of projecting ledges, both above and below sight lines as specified for surrounding surfaces.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 Mechanical and Electrical Equipment

.1 Paint exposed conduits, piping, hangers ductwork and other mechanical and electrical equipment unless specified otherwise. Colour to match adjacent surfaces except as specified otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

3.7 Field Quality Control

.1 Advise Engineer when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.2 Co-operate with engineer and provide access to all areas of the work.

END

PART 1 - GENERAL

1.1 Related Sections	.1	Rough Carpentry:	Section 06100
	.2	Gypsum Wall Board	Section 09250

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300.

.2 Indicate, by large scale details, all materials, finishes, dimensions, anchorage and assembly.

PART 2 - PRODUCTS

2.1 Materials

.1 Type 304, 18 gauge stainless steel corner guard with satin finish of one piece construction. Exposed edges and corners are to be rounded. No sharp edges will be permitted. Standard of Acceptance: Bobrick Model B-633-48.

2.2 Accessories

.1 Fasteners: self-tapping stainless steel, concealed mounting.

.2 End caps and mounting hardware shall be furnished by manufacturer to complete the assembly.

PART 3 - EXECUTION

3.1 Installation

.1 Install units on solid backing and erect with materials and components straight, tight and in alignment.

.2 Mechanically fasten corner guards to substrate.

.3 Install corner guards on all outside corner conditions.

END

PART 1 - GENERAL

1.1 Related Work	.1	Wood Doors:	Section 08210
	.2	Steel Doors and Frames	Section 08111

1.2 Shop Drawings	.1	Shop drawings in accordance with Section 01300 - Submittals.
	.2	Indicate one sign of each major type at full size or half size indicating letter style, type, spacing between letters, spacing to edges of sign board, proposed location on doors or interpretation of location indicated on drawings and installation details.
	.3	Provide complete signage schedule.

PART 2 - PRODUCTS

2.1 Materials	.1	Plastic laminate: 3 mm thick.
	.2	Bristal board backing minimum 3 mm thick.
	.3	Fasteners: nickle-plated screws.

2.2 Fabrication	.1	Room Identifiers: Name of space on top line in Inuktituk, 60 pt, Helios/Helvitica uppercase. Name of space on lower line in English, 60 pt, Helios/Helvetica translation. Sign size overall to be 450 x 125 x 3 mm thick laminated plastic.
	.2	International Graphic Symbol: 150 mm x 150 mm x 3 mm thick for male/female facility identifiers 90 mm x 9 mm x 3 mm thick for wheelchair facility identifiers.

2.2 Fabrication (Cont'd)

.3 Colours: all signage to feature dark blue lettering and/or graphics (ASI-SC-602) on pale grey field (ASI-SC-902).

.4 Fastening: pre-drill all signs at corner with countersunk hole to accept nickel-plated screws. Holes to be 15mm from each adjacent edge.

PART 3 - INSTALLATION

3.1 Installation

.1 Mount room identifiers on doors as directed by the architect.

.2 Signage to be installed after final paint coat is complete.

.3 Clear signs to manufacturer's directions.

END

Interior Signage Schedule				
NO:.	**ROOM**	**NO:. REQ**	**SIGNAGE TO READ**	**DESCRIPTION**
102	Generator Room	1	Generator Room	In two languages
103	Mechanical	1	Mechanical Room	In two languages
104	Washroom	1	Washroom	In two languages/Graphic

PART 1 - GENERAL

1.1 Related Sections	.1	Metal Fabrications:	Section 05500
	.2	Rough Carpentry:	Section 06100

1.2 References

.1 ASTM A167-91, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A525M-91b, Specification for General Requirements for Steel sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process Metric.

.3 ASTM A526M-90, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

.4 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.5 CAN/CGSB-12.5-M86, Mirrors, Silvered.

.6 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame.

1.4 Closeout Submittals

.1 Provide operation and maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01721.

1.5 Extra Materials

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01300.

.2 Turnover special tools to owner at substantial completion/occupancy.

PART 2 - PRODUCTS

2.1 Materials

.1 Sheet steel: commercial quality to ASTM A526M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A167, Type 302 and 304, with satin finish.

.3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 Components

.1 Toilet tissue dispenser: double roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.
.1 Acceptable material: Bobrick Model B-2746.

.2 Paper towel dispenser: for single folded paper towels, stainless steel cabinet, hinged front panel, lock and key, surface mounted.
.1 Acceptable material: Bobrick Model B-262.

.3 Soap dispenser: liquid push-in valve, self contained 1.18 L tank, polycarbonate refill indicator stainless steel piston and valve assembly, tamper proof filler lock, surface

2.2 Components (Cont'd)

.3 Soap dispenser: (Cont'd)
mounted, exposed metal components chrome plated.
.1 Acceptable material: Bobrick Model B-2113.

.4 Mirrors:
.1 Bobrick B-165 1824, 6 mm polished plate mirror, heavy galvanized steel back, stainless steel channel frame: concealed vandalproof mounting. Provide as shown on Drawings.

2.3 Fabrication

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 Finishes

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

PART 3 - EXECUTION

3.1 Installation

.1 Install and secure accessories rigidly in place as follows:
.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Use tamper proof screws/bolts for fasteners.

3.2 Schedule

.1 Locate accessories where indicated and as follows.

.2 Toilet tissue dispenser: one in each toilet compartment.

.3 Paper towel dispenser: provide one in. washroom.

.4 Soap dispenser: one per sink.

END

PART 1 - GENERAL

1.1 Related Work .1 Miscellaneous Metal Section 05500

1.2 Scope or Work .1 Supply and install the following materials unless otherwise specified.

1.3 Submittals .1 Submit detailed shop drawings for all items indicated in this section. Submit maintenance and operating instructions for incorporation into the operatoins and maintenance manual indicated in Section 01300.

PART 2 - PRODUCTS

2.1 Materials .1 Items specified herein shell be standard manufactured items, modified if required and as specified to suit conditions of this project.

.2 Finish work shall be free from warping, open seams, weld marks, rattles and other defects. Drilling shall be reamed and exposed edges finished smooth.

2.2 Schedule of Components .1 **ExteriorS ignage:**

.1 The building name shall be in Inuktitut and English.

.2 The sign shall be supplied and installed as per the final design and layout as determined by the client and as fabricated by the local Pangnirtung Sign Shop.

.2 **ResilientB ase:**

.1 Standard toe 101.6 mm high, 3.175 mm thick including premoulded end stops and internal and external corners.

2.2 Schedule of Components (Cont'd)

.2 Resilient Base: (Cont'd)
.2 Colour as selected by the architect from manufacturers standard range.
.3 Standard of acceptance: Johnsonite-Vinyl wall base.

.3 **PrefabricatedS teelC asework:**
.1 **Materials:**
.1 Drawer slides, drawer slide suspension channels: 1.6mm thick (16ga).
.2 Cabinet slides, closure panels, kneehole rails, front members: 1.3mm (18ga) thick.
.3 Levelling devices: 1.6mm thick (16ga).
.4 False panels, pull-out shelves, cabinet floors: 1m thick (20ga).
.2 **Drawer /D oorF ronts:**
.1 Welded telescoping double pan construction.
.2 Laminated sound-deadening insulation.
.3 **Shelves:**
.1 Reinforce with return flanges and U-channel formed at front and back.
.4 **Construction:**
.1 All joints electro-spot and seam welded on all corners to form a strong, one-piece construction.
.5 Standard of Acceptance: CIF Furniture Limited: Model Numbers:
.1 Open base module with Adjustible shelf, 00-18.
.2 Cupboard module with adjustable shelf, 10-35.
.3 Sink Module, 85-35.

PART 3 - EXECUTION

3.1 Installation

.1 Install items in accordance with manufacturers printed directions.

.2 Where applicable, securely anchor components to adjacent building elements.

.3 Where items are not located on drawings, install where directed by Architect.

END

PART 1 - GENERAL

1.1 Related Work	.1	Cast-in-Place Concrete	Section 03300
	.2	Metal Fabrications	Section 05500
	.3	Steel Doors and Frames	Section 08111
	.4	Batt Insulation:	Section 07213
	.5	Interior Painting:	Section 09911
	.6	Exterior Painting:	Section 09912

1.2 References	.1	ASTM 325M-86a Specification for High-Strength Bolts for Structural Steel Joints.
	.2	ASTM A446/A446M-87 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical Quality).
	.3	ASTM 792-86 Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
	.4	CSSBI 30 M Standard for Steel Building Systems.
	.5	CSSBI Bulletin No. 7-1982 Snow Load Design Criteria for Steel Building Systems.
	.6	CSSBI Bulletin No. 9-1983 Care and Maintenance of Prefinished Sheet Steel Building Products.
	.7	CAN/CSA-G40.21-M87 Structural Quality Steel.
	.8	CSA G164-M1981 Hot Dip Galvanizing of Irregularly Shaped Articles.

1.2 References (Cont'd)

.9 CAN3-S16.1-M84 Steel Structures for Buildings (Limit States Design).

.10 CGSB 1-GP-40M-79 Primer, Structural Steel, Oil Alkyd Type.

.11 CGSB 93-GP-3M-78 Sheet, Steel, Galvanized, Prefinished, Residential.

1.3 System Description

.1 Type: rigid frame.

.2 Roof slope: as indicated.

.3 Wall system: single skin plus interior liner/vapour barrier on inset girts. Standard of Acceptance: Robinson Building Systems.

.4 Roof system: rolled standing seam with interior liner/vapour barrier panels. Standard of Acceptance: Robinson Building Systems.

1.4 Design Requirements

.1 Design building to allow for thermal movement of component materials caused by ambient temperature without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Ensure total absence of condensation on interior surfaces.

.3 Building shall be watertight.

.4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".

.5 Vapour seal building enclosure to withstand, without failure, design RH at design ambient temperature condition, maintained against interior atmospheric pressure of 250 Pa.

1.4 Design Requirements (Cont'd)

.6 Design for hourly velocity pressure of 0.84 kPa for 1/30 probability. In addition to uniform live load, design for full live load on leeward half of building frame and zero live load on windward half.

.7 Design members to withstand, within acceptable deflection limitations:
- .1 Snow load of 2.60 kPa.
- .2 Lateral load of 1/30 wind + suction.
- .3 Earthquake load of Za=1, Zv=1, v=0.05.

.8 Design building enclosure elements to accommodate, by expansion joints, movement in wall and structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration or glass breakage.

.9 Design foundations in accordance with NBC requirements to permissible soil loads listed in soils report indicated.

.10 Completed building shall have exterior to interior sound attenuation, of not less than STC 30.

.11 Design, assemble and secure building elements to building frame to ensure stresses in sealants and seals are within sealant manufacturer's recommended maximum.

.12 Design building assembly to permit easy replacement of components.

.13 Allow for ceiling, piping, conduit and other interior dead loads imposed on this structure.

.14 Building interior environment shall be heated and cooled to maintain temperature of 20 °C minimum to 25 °C maximum with relative humidity of 25 % to 50 %.

.15 Building glazing shall provide control of solar energy.

.16 Access units, doors, and windows to sizes and locations indicated weather resistant

1.4 Design Requirements (Cont'd)	.16	(Cont'd) insulated weatherstripped fire resistant hours.
1.5 Performance Requirements	.1	Maximum deflection for roofing under full specified live load: 1/360 of clear span.
	.2	Maximum deflection for exterior cladding under full specified exterior wind induced loads:1/360 of clear span.
	.3	Maintain following tolerances for building structure and enclosure elements. .1 Maximum variation from plane or location shown on shop drawings: 1 mm/1 m of length and up to 1 mm/5 m maximum. .2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.
1.6 Source Quality Control	.1	Provide certification from steel building systems manufacturer that erector is qualified to erect system.
1.7 Shop Drawings	.1	Submit shop drawing in accordance with Section 01300 - Submittals.
	.2	Submit shop drawings bearing stamp and signature of professional engineer registered with NAPPEG.
	.3	Submit the following documents in accordance with CSSBI 30 M para 13: .1 Erection drawings showing foundation loads, anchor bolt setting details part numbers, connections and assembly details.
	.4	Indicate plans and grid lines, structural members and connection details, bearing and anchorage details, roof cladding, wall cladding, metal liner/vapour barrier and vapour barrier sealing, framed openings,

1.7 Shop Drawings (Cont'd)

.4 (Cont'd) accessories, schedule of materials and finishes, camber, loads and reaction forces, fasteners and welds, sealant locations and details.

.5 Indicate shop and erection details including cuts, copes, connections, holes, threaded fasteners, rivets and welds. Indicate welds by CSA welding symbols.

.6 Indicate on shop drawings related provisions required for mechanical, electrical and other work.

1.8 Certification

.1 Submit complete calculated thermal design analysis based on ASHRAE zone method or tests certified by an independent laboratory. Analysis shall be signed and sealed by a qualified professional engineer registered with NAPPEG.

.2 Submit following documents in accordance with CSSBI 30 M para 14:

.1 Certification that building is in accordance with contract requirements.

.2 A structural analysis certification of building system.

.3 Certification stating design criteria used and loads assumed in design and placing sole responsibility for design of building components with steel building systems manufacturer.

1.9 Protection

.1 Protect prefinished steel sheet during fabrication, transportation, site storage and installation in accordance with CSSBI Bulletin No. 9.

.2 Handle and protect galvanized materials from damage to zinc coating. During storage space surfaces of galvanized materials to permit free circulation of air.

PART 2 - PRODUCTS

2.1 Materials

.1 Structural steel: to CAN/CSA-G40.21, shop primed.

.2 Bolts: to ASTM A325M complete with nuts and washers.

.3 Welding materials: to CSA W59.

.4 Shop primer paint: to CGSB 1-GP-40M.

.5 Steel sheet, zinc-coated: to ASTM A446-/A446M, structural quality grade A with Z275 coating, regular spangle extra smooth surface, passivated for unpainted finish and unpassivated for paint finish.

.6 Steel sheet, aluminum-zinc alloy coated: to ASTM A792, structural quality grade 33 with AZ150 coating, regular spangle surface, passivated for unpainted finish and unpassivated for paint finish.

.7 Prefinished system for steel sheet exposed to interior and exterior: aluminum-zinc alloy coated material with factory applied paint system:

.8 Screws: corrosion resistant purpose made, head colour to match attached sheet.

.9 Insulation and tape: as recommended by steel building systems manufacturer.

.10 Insulation adhesive: purpose made for insulation type and steel liner sheet, incombustible after initial set.

.11 Vapour barrier closures, gaskets and sealing tape: as recommended by steel building systems manufacturer.

.12 Sealants: as recommended by manufacturer.

2.2 Fabrication

.1 Fabricate structural members in accordance with shop drawings and to CAN3-S16.1. Tolerance not to exceed those specified in CSSBI 30 M.

.2 Provide holes for attachment of other work, as indicated.

.3 Reinforce openings to maintain design strength.

2.3 Shop Painting

.1 Clean, prepare surfaces and shop prime structural steel to CAN3-S16.1.

2.4 Wall System Components

.1 Wall System Standard of Acceptance: Robinson Building Systems.

.2 Exterior sheet: factory preformed steel sheet, aluminum-zinc alloy coated prefinished, minimum 0.6 mm base metal thickness from manufacturer's standard profiles. Include closures, gaskets, caulking, flashing and fasteners to effect weathertight installation. Cut ends of sheets square and clean. Profile, as selected by Architect from Manufacturers standard line.

.3 Exterior corners: of material to match finish and profile of adjacent cladding material, shop cut and brake formed to correct angle.

.4 Accessories to exterior wall cladding, brake or bend to shape, of material and finish to match wall cladding, comprising cap flashings, drip flashings, internal corner flashings, copings, and closures for head, jamb, sill and corners.

.5 Interior liner sheet: factory preformed steel sheet, minimum 0.6 mm base metal thickness, aluminum-zinc alloy coated, prefinished of manufacturer's standard profile suitable for air/vapour barrier and liner use, with male and female side lap. Install sealant material

2.4 Wall System Components (Cont'd)

.5 Interior liner sheet: (Cont'd) in female lap, horizontally at top and bottom of each panel length, and as required to achieve air/vapour seal. Cut ends of sheets square and clean. Profile, As selected by the architect from manufacturers standard line.

.6 Sub-girts and clips: factory preformed steel sheet aluminum-zinc alloy coated.

.7 Foam Closure: neoprene to match sheet profile.

2.5 Roof System Components

.1 Exterior sheet: factory preformed steel sheet minimum 0.6 mm base metal thickness aluminum-zinc alloy coated, prefinished from manufacturer's standard profiles for roll formed standing seam hidden fastener system. Include closures, gaskets, caulking, flashing and fasteners to effect weathertight installation. Cut ends of sheets square and clean. Profile, as selected by the Architect from manufacturers standard line.

.2 Accessories to roof cladding: brake or bend to shape, of material and finish to match roof cladding or wall cladding where applicable, comprising cap flashings drip flashings coping and closures for corners fascia soffit.

.3 Sub-purlins and clips: factory preformed steel sheet minimum aluminum-zinc alloy coated.

.4 Interior sheet: factory preformed steel sheet minimum 0.6 mm base metal thickness, aluminum-zinc alloy coated prefinished of manufacturer's standard profile with male and female side lap. Install sealant material in female lap, at closures, and as required for air/vapour tight installation. Cut ends of sheets square and clean.

PART 3 - EXECUTION

3.1 Erection

.1 Do work in accordance with CSSBI Standard for Steel Building Systems 30 M except where specified otherwise.

.2 Erect structural frame in accordance with shop drawings and to CAN3-S16.1. Erection tolerances not to exceed those specified in CSSBI 30 M.

.3 Prepare galvanized structural steel surfaces for field welding by removing zinc before welding. After welding, chip away flux and prime with CGSB 1-GP-178 Ma.

.4 Obtain written permission of Consultant prior to field cutting or altering of structural members.

.5 Touch up with shop primer bolts, rivets, welds and burned or scratched surfaces where exposed at completion of erection.

3.2 Wall Cladding

.1 Install wall cladding assemblies ensuring a completed installation.

.2 Secure sub-girts to structural wall supports.

3.3 Roof Cladding

.1 Secure side laps with on site machined lock seam. Roll floating clips integrally with side seam.

.2 Continuously seal end and side laps.

.3 Install roof assemblies ensuring a completed installation.

3.4 Liner Sheet

.1 Install interior ceiling and wall liner panels to ensure continuous vapour and air barrier.

.2 Install all necessary closures, gaskets, caulking sealants and flashings.

3.5 Thermal Insulation

.1 Install insulation and vapour retarder to maintain continuity of thermal and moisture protection to building elements and spaces.

.2 Fit insulation closely around and behind electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 For roof system, apply insulation in ceiling to form continuous thermal barrier in conjuction with vapour barrier formed by ceiling panels.

.5 For roof system, ensure continuous vapour and air barrier seal by pre-caulking joints of ceiling panel.

END

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END

PART 1 - GENERAL

1.1 General	.1	This section covers items common to all sections of Division 15.
1.2 Equipment Installation	.1	Unions or flanges: provide for ease of maintenance and disassembly.
	.2	Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
	.3	Equipment drains: pipe to floor drains where noted on drawings or specified.
	.4	Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.
1.3 Anchor Bolts and Templates	.1	Supply anchor bolts and templates for installation by other divisions where required.
1.4 Protection of Openings during Construction	.1	Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
1.5 Electrical	.1	Electrical work to conform to Division 16 Canadian Electrical Code, Territorial/Local Authorities and include the following: .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated herein. .2 Control wiring and conduit is specified in Division 16 and 15.

1.6 Motors

.1 Provide motors to CSA Standards for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Engineer for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motor phase, cycle and voltage are specified within this Division. Coordinate with Division 16 regarding specified or substitute motors. Refer discrepancies to Engineer for review.

.4 Motors over 0.75 kw to be high efficiency where noted. Motors to be TEFC, ODP, ect as specified where not indicated motors to be open drip proof (ODP) for pumps and Open for fans.

1.7 Equipment Supports

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 15.

.2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of Section 05121 - Structural Steel for Building. Submit structural calculations with shop drawings.

.3 Mount all base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm high and minimum 100 mm larger than equipment dimensions all around. Where required increase dimensions to allow installation anchors to manuf. recommendations that require more than 100mm clearance from the anchor to the edge of the pad. Concrete specified in Section 03302 - Cast-in-Place Concrete to be reinforced with 152 x 152 8/8 MW welded wire mesh unless otherwise noted.

.4 All equipment supports of structural steel to be mounted on concrete housekeeping pads and secured to pad with approved insert type anchors or where approved system not used anchored through pad as per drawing details.

1.8 Sleeves

.1 Pipe sleeves: at points where pipes pass through concrete, fire rated assemblies and as indicated.

.2 All sleeves to be min 18ga formed steel or galvanized sched 10 pipe.

.3 Provide sleeves with annular fin continuously welded at midpoint or offset:
.1 Where sleeve extends above finished floor. Secure fin in floor.
.2 Where sleeve set in wall. Sleeve offset to one side of wall or adjust annular fin to center sleeve thru wall. Secure fin to wall.

.4 Sizes: min6 to max13 mm clearance all around, between sleeve and insulation/pipe.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB-1.181-92.

1.9 Firestopping Systems

.1 Metallic uninsulated unheated pipes not subject to movement(FO):
.1 Sleeves not required. Fire stop piping with listed intumescent sealant to manuf. listings.

.2 Metallic insulated pipes not subject to movement (DCW Service):
.1 Sleeve penetration and secure to wall. Pipe insulation to be continuous thru sleeve Pack void with approved fire stop insulation or backing to ULC listing of sealant. Fire seal sleeve to wall with listed intumescent sealant to manuf. listings. Fire seal insulation to sleeve with minimum thickness listed intumescent sealant as per ULC listing of sealant.

.3 Metallic insulated pipes subject to movement (HW/DHW/DHWR):
.1 Sleeve penetration and secure to wall. Pipe insulation to be continuous thru sleeve Pack void with approved fire stop insulation or backing to ULC listing of sealant. Fire seal sleeve to wall with listed intumescent sealant to manuf. listings. Fire seal insulation to sleeve with minimum thickness

1.9 Firestopping Systems (Cont'd)

.3 (Cont'd)
.1 (Cont'd)
listed intumescent sealant as per ULC listing of sealant.

.4 Plastic uninsulated pipes 50dia or less:
.1 Sleeves not required. Fire and smoke seal piping in place with listed intumescent sealant to manuf. and ULC listings.

.5 Plastic uninsulated pipes 63dia or larger:
.1 Sleeves not required. Provide listed fire stop collar smoke sealed in place with listed intumescnet sealant to manuf. and ULC listings.

.6 All piping/duct penetrations thru 45min rated assemblies without separations to be cold smoke sealed/fire sealed with listed intumescent sealant or approved cold smoke sealed at fire penetrations to sealant ULC listing.

.7 Intumescent sealant:
.1 ULC/FM listed flexible intumescent sealant suitable as fire and smoke sealant, Acceptable materials: Hilti FS-One/3M.

.8 Intumescent Fire Stop Collars:
.1 ULC/FM listed with galvanized metal collar, intumescnet fire sealant for use with PVC and ABS sched 40 drainage piping, Acceptable material: Hilti CP 642/643/3M

1.10 Escutcheons

.1 On pipes passing through walls, partitions, floors and ceilings in finished areas.

.2 Simulated chrome finish plastic one piece or split type without set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

1.11 Painting

.1 As per Section 09911/09912 - Painting.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Prime and touch up marred finished paintwork to match original.

.4 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.12 Spare Parts

.1 Furnish spare parts in accordance with Section 01700 - Project Close Out and as follows:
.1 One casing joint gasket for each size pump.
.2 One set of belts for each piece of machinery.
.3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
.4 20L pail of corrosion inhibitors to match specified propylene glycol HW water media.
.5 Additional sealed drum of specified premixed HW media.

1.13 Special Tools

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and as indicated in equipment specifications and in accordance with Section 01700 - Project Close Out.

1.14 Dielectric Couplings

.1 General:
.1 To be compatible with and to suit pressure rating of piping system.
.2 Where pipes of dissimilar metals are joined.

.2 Pipes 50 dia. and under: isolating unions, flanges or cast brass adapters.

1.14 Dielectric Couplings (Cont'd)

.3 Pipes 65 dia. and over: isolating flanges.

1.15 Drain Valves

.1 Locate at low points and at section isolating valves unless otherwise specified.

.2 Minimum 13 dia. class 150, regular port, brass body/ plated ball, brass gland, PTFE teflon seat, steel lever handle, c/w hose end, cap and chain.
.1 Acceptable Material: MA Stewart B1/B2 with hose end, cap and chain.

1.16 Demonstration and Operating and Maintenance Instructions (Building Systems)

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Where specified elsewhere in Division 15, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.4 Operating personnel shall be contacted at the beginning of the project and encouraged to come on site at least once a week for the duration of the project. During these periods, they shall be given full explanation of the various systems as the project progresses.

.5 One week prior to interim inspection, operating personnel shall be given instruction for a period of 3 days with minimum of two hours per day. Instruction to be provided during regular work hours.

.6 Training to be limited to operation of buiding mechanical systems including heating, ventilation, sanitary and fire protection.

1.16 Demonstration and Operating and Maintenance Instructions (Building Systems) (Cont'd)

.6 (Cont'd)
Training of sewage treatment process is provided by STP supplier.

.7 Maintain log of all site visits. Maintenance personnel to login/out and be witnessed by Contractor. Provide log as requested.

1.17 Operation and Maintenance Manual

.1 Provide operation and maintenance manual as specified in Section 01300 - Submittals.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Engineer.

.3 Scope of manual to be limited to buiding mechanical systems including controls, heating, ventilation, sanitary and fire protection. Manual for sewage treatment process is provided by STP supplier.

.4 Operation data to include:
.1 Control schematics for each system including environmental controls.
.2 Description of each system and its controls.
.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for each system and each component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.5 Maintenance data shall include:
.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required and task time.

.6 Performance data to include:
.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

1.17 Operation and Maintenance Manual (Cont'd)

.6 Performance data to include:(Cont'd)
.2 Equipment performance test results.
.3 Testing, adjusting and balancing reports as specified in Section 15990 - Testing, Adjusting and Balancing.

.7 Equipment data to include:
.1 Complete reviewed shop drawings of all mechanical equipment including details of suppliers.

.8 Record Drawings:
.1 Provide reduced photocopy of mechanical as built drawings. Drawings to be reduced to approx 279mmx432mm and to be reduced scale. Blueline copies are not acceptable.

.9 Append completed controls as built documentation.

1.18 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances. eg. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify as to current model production.
.5 Certification of compliance to applicable codes.

1.19 Cleaning

.1 Clean mechanical systems in accordance with Section 01700 - Cleaning.

.2 Clean interior and exterior of all systems including strainers. Vacuum interior of air handling units.

.3 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.20 Record Drawings

.1 Site records as per Section 01300 and as follows:

.1 Engineer will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Use different colour waterproof ink for each service.

.3 Make available for reference purposes and inspection at all times.

.4 Transfer valve schedule number to site records identifying all tagged valves on drawings.

.5 Transfer total corrected HW media volume to site records.

.2 Record drawings as per Section 01300 and as follows:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of Record drawings.

.2 Record information to be transferred to final record files and hardcopy mylars utilizing ACAD R2000. Drawing standards to be as per current standards utilized for completion of original drawings.

.3 Provide full size mylar drawings for review by Engineer. Provide final copies including all necessary changes.

.4 Transfer valve schedule number and copy of valve schedule identifying all tagged valves on drawings.

1.21 Site Inspections

.1 Provide for mechanical job foreman and representatives of all applicable mechanical sub trades to be on site and available during periodic site inspections by Engineer.

.2 Provide materials to Engineer as required to assist with site inspections including but not limited to drawings, specifications, scales, tape measures, ladders, lights.

1.22 Scope of Work General Description

.1 Provide for complete and operational building mechancial system as specified herein and as noted on drawings. This shall include but not be limited to:

.1 Building mechanical system controls as specified in Section 15991.
.2 Building heating systems.
.3 Building ventilation systems.
.4 Building fire protection systems.
.5 Building sanitary systems.

.2 Provide for piping connections to process equipment as specified herein and as indicated on mechanical drawings.

.3 All process equipment will be provided by the equipment supplier with shipping and installation specified under the Architectural and Structural Divisions of this specification. Coordinate with all trades installation of this equipment to allow installation of process piping systems specified under this Division.

END

PART 1 - GENERAL

1.1 General

.1 This section covers testing of piping systems and duct systems and startup of systems common to all sections of Division 15.

1.2 Definitions

.1 Initial Tests:
.1 Tests performed prior to final tests to verify general systems integrity. Tests are performed by the Contractor at their discretion.

.2 Final Tests:
.1 Mandatory tests performed to confirm system integrity. Final tests to be witnessed by Engineer and Authority having jurisdiction except where specifically noted.

1.3 Test Notification

.1 Give 14 days written notice of date and test type for Final Site Tests.

.2 Provide written notice as per the requirements of Section 01300-Submittals.

.3 Written notice to include request for confirmation of witnessing of Final Site Tests by Engineer and Authority having jurisdiction.

1.4 Costs

.1 Bear all costs for testing, making good and retesting.

.2 Final Site Tests are not complete until accepted by Engineer and Authority having jurisdiction. No additional payment shall be made for retesting to meet requirement of these parties for acceptance of tests.

1.5 Witnesses

.1 Witnessing of tests by the Engineer and Authority having jurisdiction may be provided by designated Alternates at the discretion of the Engineer or Authority having jurisdiction.

1.6 Acceptance of Tests

.1 Initial tests are not required to be witnessed or accepted by Engineer or Authority having jurisdiction.

.2 Final tests are required to be witnessed and accepted by Engineer and Authority having jurisdiction except where otherwise noted. Tests shall be deemed accepted when witnessed and relevant copies of test sheets signed and witnessed by Engineer and Authority having jurisdiction.

.3 Waiving of Acceptance of Tests: The Engineer and Authority having jurisdiction may waive the requirement of witnessing final site tests. Obtain written verification that Acceptance of Test is waived prior to proceeding with test and append to relevant test certificates.

1.7 Tests (General)

.1 Insulate or conceal work only after testing and approval by Engineer.

.2 Conduct tests from commencement to finish in presence of Engineer and Authority having jurisdiction or designated Alternate witnesses except where Acceptance of test is waived as per Part 1.6.3.

.3 Bear costs including retesting and making good.

.4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.8 Piping Tests Site Construction

.1 General:

.1 Provide the following tests for complete assembled systems.

.2 Section systems as necessary for all initial tests and test complete system for final tests.

.2 HW and Steel/Copper Process Piping:

.1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure 413kPa. Minimum 30 minutes.

.2 Final test: Hydraulic. Minimum 860kPa. Minimum 24hrs.

.3 DWV and RWL piping:

.1 Initial test: Provide for sectional ball tests to CPC where directed by Engineer or Authorities having jurisdiction.

.2 Final tests: Hydraulic test for all drainage piping with minimum 1.5 m of hydrostatic head for 15 minutes.

.4 Domestic water(Rigid Piping):

.1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure not less than 413kPa. Minimum 30 minutes.

.2 Final test: Hydraulic. Minimum 860kPa. Minimum 12hrs.

.5 Domestic water(PEX Tubing):

.1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure not less than 275kPa. Minimum 30 minutes.

.2 Final test: Hydraulic. Minimum 689kPa. Minimum 12hrs.

.6 Domestic water(PEX-AL Tubing):

.1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure not less than 275kPa. Minimum 30 minutes.

.2 Final test: Hydraulic. Minimum 689kPa. Minimum 12hrs.

.7 Process Piping(PVC):

.1 Initial test: Pneumatic not acceptable.

.2 Final test: Hydraulic. Minimum 689kPa. Minimum 12hrs.

1.8 Piping Tests Site Construction (Cont'd)	.8	Fuel Oil: .1 Test system in accordance with CAN/CSA-B139-M91 and CAN/CSA-B139-M91 and authorities having jurisdiction. .2 Test all suction and supply piping under 15in Hg vacuum and maintain vacuum for minimum 5min without loss of vaccum with no additional vacuum applied during test period.
	.9	Process Piping (Steel-Air): .1 Pressure test for 4h minimum to 413kPa, with outlets closed and with blowers isolated from system. Pressure drop not to exceed 10kPa.
	.10	Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
1.9 Ducting Tests Site Construction	.1	Duct leakage tests are not required where ducting installed as per specified requirements.
1.10 Test Sheets/ Log Books	.1	General: for each test maintain log book/test sheets.
	.2	All Final Site test logs/sheets to be verified and signed by testing personnel and attending witnesses from Contractor, Engineer or designated alternate and Authority having jurisdiction or designated Alternate.
1.11 Mechnaical System Start Up (Building Systems)	.1	Conduct operating startup to confirm that mechanical equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct startup as soon as conditions permit. Make changes, repairs, adjustments and replacements required as tests may indicate prior to final operating tests.

1.11 Mechnaical System Start Up (Building Systems) (Cont'd)

.2 During start up advise Engineer in writing of any system deficiencies that are evident and request direction.

.3 Make start up for a minimum of seven days under maximum available operating load conditions and include the following:

.1 Operate all air systems at normal operating set points.

.2 Operate all AHU for minimum 2 days at 100% O/A economizer condition for building preflush for the final two days of startup.

.3 Operate all heating systems at normal operating set points.

.4 Operate all sanitary systems at normal operating set points.

.5 Operate all life safety systems at normal operating condition.

.6 Where seasonal lockout of equipment is specified override seasonal lockout and operate equipment for full seven days of startup.

.7 Where lead/lag or main/standby staging specified override normal staging to change lead equipment on 24 hour rotation for full seven days of startup.

.4 Start up to occur in conjunction with Controls Contractor controls startup and testing.

.5 During startup provide the following operations and maintenance procedures:

.1 Lubricate bearings, adjust and/or replace and set direct and V belt drives for proper alignment and tension.

.2 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.

.3 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.

.4 Replace and clean filters. Clean fan wheels and coils.

.5 Clean out and prime all floor drain traps using trap seal primers or other means acceptable to the Canadian Plumbing Code.

.6 Test freedom of movement of cleanouts.

.7 Aerator screens and strainers: clean out.

1.12 Start Up Log Books

.1 General: for each system startup maintain log book of startup conditions including the following information:

.1 Day

.2 Operating personnel.

.3 System status at 0800hrs/1300hrs/1800hrs including the following information:

.1 Weather conditions.

.2 Equipment set and operating points showing deviation for the following:

.1 HW Boiler EWT/LWT

.2 Bldg HWS.

.3 Bldg HWR.

.4 AHU H/C HWS.

.5 AHU H/C HWR.

.6 AHU SF Status.

.7 AHU RF Status.

.8 AHU Filter Pressure.

.9 AHU S/A temp.

.10 AHU R/A temp.

.11 AHU O/A position.

.12 Space conditions minimum 4 heating terminal unit zones per floor.

.2 All Start Up logs to be verified and signed by testing personnel and attending witnesses from Contractor.

1.13 Building System Tests

.1 Conduct specified system tests in presence of Engineer to confirm that equipment and systems meet specified requirements. Conduct system tests during Interim inspection and only after system startup completed with the exception that system tests may take place during the final day of the Building Startup. In addition system tests are to occur in conjunction with the Controls System Commissioning specified in Section 15991. All system tests and startup are to occur prior to Interim inspection with Third Party Owner Commissioning occuring subsequent to sucessfull Interim acceptance.

.2 Where directed by the Engineer make changes, repairs, adjustments and replacements within the scope of these documents as required to allow completion of the system tests.

.3 Provide all tools and equipment necessary to complete specified tests. Patch and make good any damage created during tests at no additional cost.

.4 Provide tradespersons as required to complete specified tests for the duration of the one day testing period.

.5 Provide the following tests to be witnessed by the Engineer:
.1 Prove random access to cleanouts at the direction of the Engineer.
.2 Prove random access through access doors at the direction of the Engineer.
.3 Prove random operation of plumbing fixtures including maximum DHW temperature at high limit protected plumbing fixtures and run time on all spring or metered fixtures.

1.14 Controls System Commissioning

.1 As per Section 15991.

1.15 Process System Startup

.1 System startup provided by Process Plant Supplier (BCA) over 5 consecutive day period. Provide for assistance during startup procedures.

.2 Provide for journeyman plumber or pipefitter to be on site two consecutive 8 hour days during first two days of startup and for 2 hrs per day for final three days.

.3 Provide assitance to operate, adjust and repair all equipment installed under this Section to enable process startup to be completed.

END

PART 1 - GENERAL

1.1 Reference Standards

.1 Do the work in accordance with the following standards except where specified otherwise:

.1 ANSI/ASME B31.1-1995: ASME Code for Pressure Piping and Power piping.

.2 ANSI/ASME Boiler and Pressure Vessels Code - 1986:

.1 Section 1: Power Boilers.

.2 Section V: Non-destructive Examinations.

.3 Section IX: Welding and Brazing Qualifications.

.3 CSA W48 series Electrodes.

.4 CSA B51-M95 Boiler, Pressure Vessel and Pressure Piping Code.

.5 CAN/CSA-W117.2-94 Code for safety in welding and cutting (Requirements for welding operators).

.6 AWS B3.0-1980 Welding procedures and performance qualifications.

.7 AWS C1.1-66 Recommended practices for resistance welding.

1.2 Welders Qualifications

.1 Welding qualifications to be in accordance with CSA B51-M95.

.2 All welders to be qualified and certified in the Nunavut Territory. Provide certificate from authority having jurisdiction prior to commencing any welding..

.3 Furnish welder's qualifications upon request to Engineer at any time.

.4 Each welder to possess identification stamp issued by authority having jurisdiction where applicable.

1.3 Welding Procedures

.1 Registration of welding procedures in accordance with CSA B51-M95.

.2 Copy of welding procedures to be available for inspection at all times.

PART 2 - PRODUCTS .3 Not applicable.

PART 3 - EXECUTION

3.1 Workmanship .1 Welding to be in accordance with ANSI/ASME B31.1-1995 and ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX, using procedures conforming to relevant AWS codes and special procedures specified elsewhere in Division 15.

3.2 Installation Requirements .1 Identify each weld with welder's identification stamp.

.2 Backing rings:
.1 Where used, fit to minimize gaps between ring and pipe bore.

.3 Fittings:
.1 NPS 2 and smaller: install welding type sockets.
.2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 Inspection and Tests - General Requirements .1 Review all weld quality requirements and defect limits of applicable codes and standards with Engineer before any work is started.

.2 Provide for Engineer to randomly visually inspect welds during early stages of welding procedures. Repair or replace all defects as required by codes and as specified herein.

3.4 Defects Causing Rejection .1 As described in ANSI/ASME B31.1-1995 and in AANSI/ASME Boiler and Pressure Vessels Code 1986.

3.5 Repair of Welds Which Failed Tests .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/ASME B40.1-1991, Gauges-Pressure, Indicating Dial Type-Elastic Element.

.2 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.3 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate on manufacturers catalogue literature the following:
- .1 Thermometers.
- .2 Pressure gauges.
- .3 Wells.

PART 2 - PRODUCTS

2.1 General

.1 Thermometers and pressure gauges to operate at mid point of scale or range.

2.2 Direct Reading Thermometers

.1 Accuracy +/-1% of dial span throughout entire range to CAN/CGSB-14.4-M88.

.2 Case: hermetically sealed, 304 stainless steel socket with slip ring.

.3 Helix: silicone dampening of bimetallic element.

.4 Socket and Stem: 304 stainless steel.

.5 Stem length: 100mm-150mm as required for insulation.

.6 Dial: white coated aluminum with black lettering.

2.2 Direct Reading Thermometers (Cont'd)

.7 Lens: flat glass

.8 Size: 50mm

.9 Ranges:
- .1 HW&DW: 0 to 120degC.
- .2 Boiler Stack: 100 to 550degC.
- .3 Duct: -70 to 70degC.

.10 Acceptable Material: Marsh/Winters Bi-metal thermometers.

2.3 Thermometer Wells

.1 For copper pipe use copper or bronze. For steel pipe use brass or stainless steel.

2.4 Pressure Gauges

.1 Dial type to ANSI/ASME B40.1-1991, self indicating, 2% accuracy and plain case with twist locking ring and recalibration adjustment.

.2 Bourdon tube: copper alloy tube, tip and socket.

.3 Dial: Steel, white enamel background, black printed labels.

.4 Lens: flat glass.

.5 Movement: brass, bronze bushings, stainless steel pinion and arbor.

.6 Size: 50mm.

.7 Ranges:
- .1 HW:0-413kPa
- .2 DW:0-1100kPa

.8 Acceptable Material: Marsh Standard Gauges/Winters.

2.5 Vacuum Gauges

.1 Dial type to ANSI/ASME B40.1-1991, self indicating, 2% accuracy and plain case with twist locking ring and recalibration adjustment.

2.5 Vacuum Gauges (Cont'd)

.2 Dial: Steel, white enamel background, black printed labels.

.3 Lens: flat glass.

.4 Movement: brass, bronze bushings, stainless steel pinion and arbor.

.5 Size: 50mm.

.6 Ranges:
.1 FO: 30" Hg

.7 Acceptable Material: Marsh Standard Gauges/Winters.

2.6 Gauge Isolation Valves

.1 Class 600, regular port, threaded, bronze body, plated brass ball, brass gland and PTFE Teflon seat, wing handle, screwed.
.1 Acceptable material: Kitz, Toyo.

PART 3 - EXECUTION

3.1 General

.1 Install so they can be easily read from floor or platforms.

.2 Install between equipment and first fitting or valve.

3.2 Thermometers

.1 Install in wells on all piping. Provide heat conductive material for inside of well.

.2 Install in locations as follows:
.1 HW/DW: as indicated on drawings.
.2 Ventilation:
.1 AS 1: S/A, O/A, R/A, PHC S/A.
.3 Fuel burning appliances:
.1 On breeching connectors for all fuel fired appliances.

3.3 Pressure and Vacuum Gauges

.1 Install in locations as indicated on drawings.

.2 Provide specified ball isolation valves for all pressure and vacuum gauges.

END

PART 1 - GENERAL

1.1 References

.1 ANSI B31.1-1983, (SI), Power Piping.

.2 ANSI/MSS SP-58-1983, Pipe Hangers and Supports - Materials, Design and Manufacture.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate on manufacturers catalogue literature the following:
.1 Upper attachment.
.2 Middle attachment.
.3 Pipe attachment.
.4 Riser clamps.
.5 Sway braces.

PART 2 - PRODUCTS

2.1 General

.1 Fabricate pipe hangers, supports and sway braces in accordance with ANSI B31.1 and ANSI/MSS SP-58-1983.

.2 Support from structural members. Where structural bearing does not exist, provide supplementary structural members.

2.2 Upper Attachments-Piping

.1 Steel joist:

.1 Cold piping 50 dia. and under: galvanized steel washer plate with double locking nuts.

.2 Steel channel, joist or angle (bottom):
.1 Malleable iron C clamp to ANSI/MSS SP-58-1983, type 23, galvanized. ULC listed.

.3 Steel channel, joist or angle (top):
.1 Malleable iron top of beam C clamp to ANSI/MSS SP-58-1983, type 19, galvanized. ULC listed.

2.2 Upper Attachments-Piping (Cont'd)	.4	Concrete: .1 Insert type expanding anchor with 10dia internal threaded rod connection, galvanized steel, CSTB approved. ULC listed.
2.3 Middle Attachment (rod)	.1	Electro-galvanized carbon steel threaded rod.
2.4 Pipe Attachment	.1	All cold steel, cast iron and PVC/ABS piping, all hot steel piping and all copper piping where insulation shields and inserts provided: adjustable clevis to ANSI/MSS SP-58-1983, type 1, ULC listed..
	.2	All cold and hot copper piping where insulation shields and inserts not provided: adjustable clevis to ANSI/MSS SP-58-1983, type 1, Copper plated.
2.5 Piping Riser Clamps	.1	Steel or cast iron pipe: galvanized black carbon steel to ANSI/MSS SP-58-1983, type 42. ULC listed.
	.2	Copper pipe: Carbon steel ANSI/MSS SP-58-1983, type 42. ULC listed with copper finish.
2.6 Rigid Piping Floor and Wall Clamps	.1	Continuous slot formed hot dipped galvanized channel, 12-14Ga with proprietary mounted fasteners and standard pipe clamps.
2.7 Trapeze Hangers	.1	Continuous slot formed hot dipped or electro-galvanized channel, 12Ga minimum with proprietary mounted fasteners and electro galvanized pipe clamps.

2.8 Saddles and Shields

.1 Shields: Formed metal insulation shields, carbon steel, galvanized finish, to WW-H-171E(Type 41).

.2 Saddles: formed carbon steel plate, to WW-H-171E(Type 40A/40B).

2.9 Flexible Piping Systems

.1 Continuous slot formed hot dipped galvanized channel, 12-14Ga with proprietary mounted fasteners and standard pipe clamps.

.2 Polypropylene single pipe hanger.
.1 Acceptable material: Kitec 88300 thru 88303.

2.10 Special Hanger Finish

.1 For all piping hanging systems located in sewage treatment plant provide corrosion resistant epoxy painted coating. Painting as per Section 09900. Color black.

PART 3 - EXECUTION

3.1 Hanger Spacing

.1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.
.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
.2 Copper piping: up to 13 dia: every 1.5 m.
.3 Within 300 mm of each horizontal elbow.

Pipe Size	Rod Diameter	Maximum Spacing Steel	Copper	PVC(s40/80) t=38degC
(up to)				
32 dia.	10 mm	2.1 m	1.8 m	1.1m
38 dia.	10 mm	2.7 m	2.4 m	1.6m
50 dia.	10 mm	3.0 m	2.7 m	1.7m
63 dia.	10 mm	3.6 m	3.0 m	1.7m

3.1 Hanger Spacing (Cont'd) .1 (Cont'd)
.3 (Cont'd)

Pipe Size	Rod Diameter	Maximum Spacing Steel	Copper	PVC(s40/80) t=38degC
75 dia.	10 mm	3.6 m	3.0 m	2.2m
100 dia.	16 mm	4.2 m	3.6 m	2.6m
150 dia.	22 mm	5.1 m		3.1m

3.2 Hanger Installation .1 Offset hanger so that rod is vertical in operating position.

.2 Adjust hangers to equalize load.

3.3 Riser Clamps .1 Provide riser clamps at all floor penetrations and the base of all piping risers. Exception branch HW & DW piping 25 dia. or smaller.

3.4 Trapeze Hangers .1 Use of trapeze hangers is acceptable for parallel piping runs.

3.5 Shields and Saddles .1 Provide shields and saddles for all rigid HW and DW piping as indicated on drawings for the following locations:
.1 All spaces.

.2 Provide specified insulation insert for all shields.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 09911/09912 - Painting.

1.2 References

.1 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 National Fire Protection Association
.1 ANSI/NFPA 13-1999, Installation of Sprinkler Systems.

1.3 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Submit lists of proposed wording for approval before engraving lamicoids or laminating valve tags.

.3 Provide product data for the following:
.1 Pipe identification systems.

PART 2 - PRODUCTS

2.1 Manufacturers Nameplates

.1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters. Include registration plates. i.e., ASTM, ULC, CSA as required by respective agencies and as specified.

.2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 Nameplates

.1 Colour:
.1 Hazardous: red letters, white background.

2.2 Nameplates (Cont'd)

.1 Colour: (Cont'd)
.2 Elsewhere: black letters, white background

.2 Construction:
.1 3 mm thick, laminated plastic or white anodized aluminum, matte finish, square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:
.1 Conform to following table:

Size #	Dimensions (mm x mm)	Max No. of Lines	Letter Height (mm)
1	10 x 50	2	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	2	8
5	20 x 200	2	8
6	20 x 100	2	5
7	25 x 125	1	12
8	25 x 125	2	8

.2 Use average of 40 letters/numbers (maximum) per nameplate.
.3 Minimum sizes as follows:
.1 Equipment in mechanical rooms/crawlspaces/hidden spaces: Sizes 2 or 6.
.2 Equipment in finished architectural spaces: Sizes 1/3.
.3 Access doors: Sizes 1/3.

2.3 Piping

.1 General:
.1 To CGSB24 GP-3a, Identification and Classification of Piping Systems CAN/CGSB-24.3-92, Identification of Piping Systems and requirements of NFPA 13-1999.
.2 Identify medium by lettered legend, classification by primary and secondary colours, direction of flow by arrows.

.2 Sizes:
.1 Legend: block capitals to following table:

2.3 Piping (Cont'd)

.2 Sizes: (Cont'd)

.1 Legend: (Cont'd)

Outside Dia. of Pipe or Insulation mm	Size of Letters mm
19 or less	8
25 to 65	19
75 to 130	50
Over 150	90

.2 Colour bands:

.1 At valves and fittings: 500 mm long.

.2 Elsewhere: 1000 mm long.

.3 Arrows:

.1 Outside diameter of pipe/insulation 75 mm and greater: 150 mm long x 50 mm high.

.2 Outside diameter of pipe/insulation less than 75 mm: 100 mm long x 50 mm high.

.3 Use double headed arrows where flow is reversible.

.3 Material:

.1 Paint: painting to conform to Section 09911.

.2 Legend markers, arrow colour bands: plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150 deg.C and intermittent temperature of 200 deg.C. Apply to prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping one (1) pipe diameter.

.3 Waterproof and heat resistant plastic marker tags: for pipes and tubing 20 mm nominal and smaller.

.4 Colours:

.1 Where not covered by table below, submit legend and classification colours to Engineer for approval.

.5 Table:

.1 Pipe and valve identification.

2.3 Piping (Cont'd)

.5 Table: (Cont'd)

.1 (Cont'd)

Description	Legend	Background Colour
Domestic Cold water	DCW	Green
Dom. hot water	DHW	Green
Heating water supply	HWS	Yellow
Heating water return	HWR	Yellow
Heating water reverse return	HWRR	Yellow
Sanitary sewer	SAN	Green
Vent Plumbing	VP	Green
Fuel Oil Supply	FOS	Yellow
Fuel Oil Return	FOR	Yellow
Raw Sewage	Raw Sewage	Yellow
Sludge	Sludge	Yellow
Screened Sewage	Screened Sewage	Yellow
Treated Sewage	Treated Sewage	Yellow

.2 Legend and arrows:

.1 Black or white to contrast with primary colour.

2.4 Ductwork

.1 50 mm high black stencilled letters and directional flow arrows 150 mm long x 50 mm high.

.2 Painting to conform to Section 09900.

2.5 Duct Access Doors

.1 Provide lamicoid nameplates as per sub 2.2.

.2 Indicate the following information;

.1 Service: (i.e. AS-1B E/A.....)

.2 Type: (i.e. Fire Damper/Control Damper...)

.3 Normal Position (i.e. NO....)

.4 Location (i.e. Area5130-Wing A-Rm001)

.3 Size: as indicated.

2.6 Building Access Doors	.1	Provide lamicoid nameplates as per sub 2.2.
	.2	Indicate the following information; .1 Service: (i.e. AS-1B E/A.....) .2 Type: (i.e. Fire Damper/Control Damper...)
	.3	Size: as indicated.
2.7 Equipment Identification	.1	Lamicoid nameplates as per 2.2
	.2	Equipment names to be as per Equipment Identification Schedule.
	.3	Size: as indicated.
2.8 Valves Identification	.1	Plastic laminated cards attached by chain or plastic tie clip.
	.2	Sizes: 50mmx75mm minimum.
	.3	Lettering: minimum 5mm high produced from laser printer in black.
	.4	Consecutively number valves in systems and provide the following information on valve tag: .1 Service (i.e. HWS/DCW...) .2 Normal Position (i.e. NC/NO) .3 Control (i.e. ISOLATION/CONTROL/BALANCE..) .4 Location (i.e. Boiler Rm 001)
2.9 Language	.1	All identification to be in English.
2.10 Hazardous Goods	.1	Provide pictograms where required to Workplace Hazardous Materials Information System (WHMIS) regulations.

PART 3 - EXECUTION

3.1 General

.1 Do identification work in accordance with CGSB24 GP-3a, Identification and Classification of Piping Systems and NFPA 13-1999 except where specified otherwise.

.2 Provide ULC and/or CSA registration plates, as required by respective agency.

.3 Provide for equipment and systems specified in this Division only. Identification of process equipment is not required.

3.2 Piping

.1 Apply markers on piping as per the following locations:

.1 On long straight runs in open areas in equipment rooms and crawlspaces so that at least one is clearly visible from any one viewpoint in operating areas or walking aisles and not at more than 12 m intervals.

.2 At least once in each room through which piping passes horizontally.

.3 Within 1.5m on both sides of any separation such as walls, floors and partitions.

.4 Where piping is concealed in pipe chase, ceiling space or other confined space, at entry and leaving points or adjacent to each access opening.

.5 At point immediately upstream of major automatically controlled valves not including zone isolation valves. Where this is not possible, place identification as close to valve as possible, preferably on upstream side.

.6 Within 1.5m of all equipment connections.

.7 Legend to be easily and accurately readable from usual operating areas and all readily accessible points.

.8 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of

3.2 Piping (Cont'd)

.1 (Cont'd)
.8 (Cont'd)
colour or legends caused by dust and dirt and risk of physical damage.

.2 Identification Schedule
.1 Apply colour banding and identification to all exposed and concealed piping.

3.3 Ductwork

.1 Stencil over final finish only.

.2 Locations of ductwork identification:
.1 On long straight runs in open areas in equipment rooms and crawlspaces so that at least one is clearly visible from any one viewpoint in operating areas or walking isles and not at more than 12 m intervals.
.2 Where ductwork is concealed in duct chase or other confined space, at entry and leaving points or adjacent to each access opening.
.3 Legend to be easily and accurately readable from usual operating areas and all readily accessible points.
.4 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour or legends caused by dust and dirt and risk of physical damage.

.3 Identification Schedule:
.1 Provide identification for all exposed ducts.

3.4 Valves

.1 Secure tags with non-ferrous chains or plastic tie clips for all valves except where noted.

.2 Valve tags are not required in the following locations:
.1 Chrome plated plumbing fixture stops.
.2 All HW and DW drain valves.
.3 All process isolation and control valves. Valve tagging and identification to be provided by process equipment manufacturers.

3.4 Valves (Cont'd)

.3 Provide required hard copies of valve schedule and in addition one softcopy in Microsoft Word 2000 format. Provide one hardcopy laminated in plastic cover and in metal/glass frame attached to Mechanical Room wall. Provide one copy in each Operating and Maintenance Instruction Manual.

.4 Transfer tag schedule numbering to Record drawings as per Section 15010.

3.5 Duct Access Doors

.1 Lamicoids not required at terminal reheat coil access doors.

.2 Secure using adhesive backing of lamicoid and minimum two mechanical fasteners of either metal screws or pop rivets.

3.6 Building Access Doors

.1 Lamicoids not required at terminal reheat coil access doors.

.2 Secure using adhesive backing of lamicoid and minimum two mechanical fasteners of either metal screws or pop rivets.

3.7 Equipment Identification

.1 Provide nameplates for all mechanical equipment. Secure using adhesive backing of lamicoid and minimum two mechanical fasteners of either metal screws or pop rivets.

.2 Equipment identification as per Schedule and to include:

.1 Equipment description.

.2 Equipment Tag.

3.8 Equipment Identification Schedule

.1 Equipment Identification schedule as follows:

Equip Description	Equipment Tag
Ventilation:	
Air system 1	
Supply fan	SF1.1
Exhaust fan	EF1.1
Prefilter	F1.1
Final filter	F1.2
Pre Heat coil	HC1.1
Heating coil	HC1.2
Air system 2	
Supply fan	SF2.1
Filter	F2.1
Heating coil	HC2.2
Exhaust Fan	EF-1
Mech Rm Clg Fan	SF-1
Prop fan	PF-1
Prop fan	PF-2
Prop fan	PF-3
Sanitary:	
Pumps	
Pressure Pump	P-17
Main Lift Station	P-18
Tanks	
DHW Expansion	TK1.1
Fuel Systems:	
Pumps	
FO Transfer	P-19
FO Transfer	P-20
Tanks	
Main FO	TK2.1
Aux FO	TK2.2
Heating:	
Pumps	
Primary HW	P-21
Primary HW	P-22
HW Fill	P-23
Tanks	
HW Fill	TK3.1
HW Expansion	TK3.2
Appliances	
HW Boiler	B-1
HW Boiler	B-2
Terminal Units	

3.8 Equipment Identification Schedule (Cont'd) .1 (Cont'd)

*Equip	Equipment
UH	UH1.? thru 1.?
Process:	
Pumps	
Screen Spray Pump	P-24
Tanks	
Screen Spray Tank	TK4.1

END

PART 1 - GENERAL

1.1 References

.1 ASTM C 411-82(1992), Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.2 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials and Assemblies.

.3 ANSI/NFPA 90A-1993, Air Conditioning and Ventilating Systems, Installation of.

.4 CAN/CGSB-51.9-92, Thermal Insulation, Mineral Fibre, Sleeving for Piping and Round Ducting.

.5 CAN/CGSB-51.12-95, Cement, Thermal Insulating and Finishing.

.6 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.7 ASTM C 335-95, Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

.3 Provide shop drawings as follows:

- .1 P1 Insulation.
- .2 P2 Insulation.
- .3 Removable Insulation Enclosures.
- .4 Insulation PVC Jackets.
- .5 Insulation Inserts.
- .6 Insulated Valve Jackets.
- .7 Aluminum Jackets.

1.3 Definitions

.1 For purposes of this section:
.1 "CONCEALED" - insulated mechanical services and equipment in hung ceilings non-accessible chases, furred spaces and crawlspaces.
.2 "EXPOSED" - will mean "not concealed" as defined herein.
.3 "DW" - refers to DHW, DCW and DHWR piping.

PART 2 - PRODUCTS

2.1 General

.1 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with CAN/ULC-S102-M88.

.2 Materials to be tested in accordance with ASTM C 411-82(1992).

2.2 P-1 Formed Mineral Fiber to 200 deg.C

.1 Materials:
.1 CAN/CGSB-51.9-92, rigid mineral fiber sleeving for piping and CGSB SI-GP-52M vapour barrier jacket and facing material. Jacket finish to be white.

.2 Thermal Conductivity "k" shall not exceed 0.034 W/m. deg.C at 24 deg.C mean temperature when tested in accordance with ASTM C 335-95.

.3 Acceptable material: Knauf/Fiberglass/Mason.

2.3 P-2 Exterior Vent Insulation

.1 Insulation:
.1 Rigid closed cell polyurethane insulation, formed, 50 mm min thickness.
.2 Properties:
.1 Water absorption: 4% by volume.
.2 Density: 35-46kg/m3.
.3 Compressive strength: 206kPa.
.4 Thermal conductivity: 0.020 to 0.026 W/m-degC.
.5 Operating temperatures: -45 to 120degC.

2.3 P-2 Exterior Vent Insulation (Cont'd)

.2 Polymer Coating:
.1 Two component, fully bonded polymer coating on all exterior surfaces.
.2 Properties:
.1 Density: 1170kg/m3.
.2 Thickness: 1.6mm outside surfaces, 0.51mm inside surfaces.
.3 Acceptable material: Urecon BL-75-20EP.

.3 Acceptable material: Urecon.

2.4 P-2 Fitting and Joint Heat Shrink

.1 Heat shrink sleeves: One piece cross-linked polyethylene.
.1 Standard of Acceptance: Canusa

.2 Heat shrinkable tape: 150 mm wide.
.1 Standard of Acceptance: Raychem Thermaclad.

2.5 Fastenings

.1 For insulation systems P-1:
.1 Tape: self adhesive, aluminum, ULC labelled for less than 25 flame spread and less than 50 smoke developed. Colour to match insulation jacket.

2.6 Type P1 Insert Material for Fittings

.1 Insert material for Type P1 insulation systems to meet specified requirements of Type P1 insulation.

2.7 Insulation Cement

.1 To CAN/CGSB-51.12-95.

2.8 Jackets

.1 PVC:
.1 One piece premoulded PVC jacketing to AC774.1K82 with 25 flame and 50 smoke rating to ASTM E 84-95.
.2 Gloss finish, UV resistant, premoulded for fitting applications, jacket for straight pipe runs.

2.8 Jackets (Cont'd)

.1 PVC: (Cont'd)

.3 Secure with PVC tape with manuf. supplied rivets. Tape only is not acceptable.

.2 Aluminum:

.1 Apply in accordance with CSA HA Series M1980.

.2 Crimped or embossed jacketing 0.6 mm thick with longitudinal slip joints and 50 mm end laps. Aluminum alloy straps with mechanical fasteners.

2.9 Insulation Inserts

.1 Moulded perlite thermal insulation, service temp to 645°C.

.2 Acceptable material: Innova Temperlite 1200.

2.10 Insulated Valve Enclosures

.1 Insulation: Type P1 insulation.

.2 Jacket: ULC listed plain weave cotton fabric with teflon coating.

.3 Fasteners: velcro type flap along parting edges.

.4 Quilts: 300SS quilting pings with SS washers.

.5 ID Tag: printed tags encased in plastic holder.

.6 Construction: jacket sewn with inside seams formed to fit insulation, insulation secured with quilting pins to jacket.

.7 Acceptable material: Reflex style C8 Insulation Covers.

PART 3 - EXECUTION

3.1 Application

.1 Apply insulation after required tests have been completed and approved by Engineer. Insulation and surfaces shall be clean and dry when installed and during application of any finish. Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations and as specified herein.

.2 Install insulation as per details noted on drawings and as specified herein.

3.2 Installation (General)

.1 Install in accordance with ANSI/NFPA 90A-1993 and ANSI/NFPA 90B-1993.

.2 Preformed: sectional construction.

.3 Seal and finish exposed ends as follows:
.1 PVC Jacketed insulation: PVC jacket termination.
.2 Unfinished insulation: finishing cement.

.4 Insulation is not required for:
.1 All chrome plated piping and fittings
.2 Flanges and unions.

.5 Where insulation not provided at valves, fitting and trim delete insulation and finish away from studs and nuts to permit use of tools without damage to insulation.

.6 All finishes to satisfaction of Engineer.

3.3 Valve Insulation

.1 Provide removable insulated valve jackets for HW & DW valves and trim as follows:
.1 Provide the following valves and strainer types:
.1 All gate valves.
.2 All butterfly valves.
.3 All globe valves.
.4 All strainers.
.5 All exposed ball valves.

3.3 Valve Insulation (Cont'd)

.1 (Cont'd)

.2 Provide jackets in the following locations:

.1 For exposed HW valves in all Mechanical and Electrical Spaces.

.2 For exposed DCW, DHW and DHWR valves in all Mechanical and Electrical Spaces.

.3 For all exposed DCW valves regardless of location unless otherwise noted.

.3 Do not provide valve jackets for the following valves:

.1 All drain valves.

.2 Chrome plated piping, valves and fittings at plumbing fixtures.

.3 Terminal heating unit isolation, globe and flow balancing valves.

.4 All HW flow balancing valves.

.5 All PVC valves.

.2 Provide continuous pipe insulation for the HW and DW valves and trim as follows:

.1 Insulate all concealed HW/DW ball valves using specified pipe insulation continuous over valve. Core out insulation as required to suit valve body dimensions or provide one size larger pipe insulation.

3.4 Piping

.1 Insulate piping for full length as per insulation schedule except as follows:

.1 Insulate DWV vents from exterior building termination penetration 1500 mm inside building.

.2 Insulation is not required for all flexible HW and DW piping.

.3 Insulation is not required for any PVC process piping.

.4 Insulate Equilization and Sludge tank vents from wall penetration to exterior termination.

.5 Water tank fill and vents, FO supply and return: 1000mm from wall penetration.

. (Cont'd)

.2 Where insulation not provided at valves, fitting and trim delete insulation and finish away from studs and nuts to permit use of tools without damage to insulation.

3.5 Fastenings

.1 P1: Secure insulation by tape at each end and centre of each section, but not greater than 900 mm on centres.

.2 P2:

.1 Stainless steel wire/aluminum bands at maximum 900 mm on centre before application of heat shrink wrap.

.2 Heat shrink wrap at each joint of insulation for full length.

3.6 Insulation Schedule .1

Application	Insulation Type	Insulation Thickness (mm)	Jacket
Exposed Rigid HW			
(19 dia runouts)	P1	19	PVC-other
(Other)	P1	25	PVC-other PVC-mech areas
Exposed Rigid DW			
(13-50dia)	P1	13	PVC-other PVC-mech areas
(Other)	P1	19	PVC-other PVC-mech areas
Concealed Rigid HW			
(19 dia runouts)	P1	19	N/A
(Other)	P1	25	N/A
Concealed Rigid DW			
(13-50dia)	P1	13	N/A
(Other)	P1	19	N/A
Concealed Flexible HW			
(19 dia runouts)	Not required.		
Concealed Flexible DW			
(All piping)	Not Required.		
Exposed DWV Vent	P1	19	PVC
Exposed FO	P1	19	PVC
Concealed DWV	P1	19	N/A
Exposed HW Valves	Insulated valve enclosure		
Exposed DW Valves	Insulated valve enclosure		
Concealed ball Valves	P1	Pipe thk	N/A
Concealed valves Other	N/A		
Blower Air Piping	P1	32	PVC-mech areas PVC-other
Equalization Tank Vent (Exterior)	P2	50	Aluminum

3.6 Insulation .1(Cont'd)

Sludge Tank Vent (Exterior)	P2	50	Aluminum
Buried DWV	P2	50	N/A
Water Tank Fill	P1	19	PVC
Water Tank Vent	P1	19	PVC

3.7 Finishes .1 PVC:

.1 Provide where specified.

.2 Provide min 25mm overlap.

.3 Secure using flexible PVC tape and maunuf. approved rivets. Do not stretch final 50mm of tape.

.2 Metal jacket:

.1 Apply over insulation where specified.

.2 Pull up tight. Provide 25 mm overlap and secure.

.3 Final surface: to be clean and smooth.

END

PART 1 - GENERAL

1.1 References

.1 ASTM C 411-82(1992), Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.2 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials and Assemblies.

.3 ANSI/NFPA 90A-1993, Air Conditioning and Ventilating Systems, Installation of.

.4 CAN/CGSB-51.2-95, Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.

.5 CAN/CGSB-51.12-95, Cement, Thermal Insulating and Finishing.

.6 ASTM C 177-85(1993), Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.7 CSA HA series M1980, CSA standards for aluminum and aluminum alloys.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Submit for approval manufacturer's catalogue literature related to installation.

.3 Provide shop drawings as follows:
.1 Type E-1 Insulation
.2 Type E-2 Insulation
.3 Recovery Systems.
.4 Air Seperator Insulated Enclosures.

1.3 Definitions

.1 For purposes of this section:
.1 "CONCEALED" - insulated mechanical services and equipment in hung ceilings, non-accessible chases, furred spaces and crawlspace/tankroom.

1.3 Definitions (Cont'd)

.1 (Cont'd)
.2 "EXPOSED" - will mean "not concealed" as defined herein.

PART 2 - PRODUCTS

2.1 General

.1 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with CAN/ULC-S102-M88.

.2 Materials to be tested in accordance with ASTM C 411-82(1992).

2.2 E-1 Calcium Silicate

.1 Materials: Preformed incombustible calcium silicate to CAN/CGSB-51.2-95.

.2 Thermal conductivity "k" shall not exceed 0.059 W/m deg.C at 93 deg.C mean temperature, service temperature to 750 deg.C.

2.3 E-2 High Temp Matt Insulation

.1 Alumina silica continuous matt.

.2 Acceptable material: Thermal Ceramics Kaowool

2.4 Fastenings

.1 Contact adhesive: quick-setting asbestos free.
.1 Acceptable material: Foster 85-20 asbestos free.

.2 Stainless steel wire: 1.2 mm diameter, type 304.

2.5 Jackets

.1 Aluminum alloy:
.1 Apply in accordance with CSA HA Series M1980.
.2 Crimped or embossed jacketing 0.6 mm thick with longitudinal slip joints and 50 mm end laps. Aluminum alloy straps with mechanical fasteners.

2.6 Insulated Enclosures

.1 Insulation: Type P1 insulation. See section 15260.

.2 Jacket: ULC listed plain weave cotton fabric with teflon coating.

.3 Fasteners: velcro type flap along parting edges.

.4 Quilts: 300SS quilting pings with SS washers.

.5 ID Tag: printed tags encased in plastic holder.

.6 Construction: jacket sewn with inside seams formed to fit insulation, insulation secured with quilting pins to jacket.

.7 Provide for the following:
.1 Vortex Type Air Seperators.

.8 Acceptable material: Reflex style C8 Insulation Covers.

PART 3 - EXECUTION

3.1 Application

.1 Apply insulation after all tests have been completed and approved by Engineer.

.2 Surface to be clean and dry during installation of insulation and finishes.

.3 If not specified herein, application to be to manufacturer's recommendations.

3.2 Installation (General)

.1 Install in accordance with ANSI/NFPA 90A-1993 and ANSI/NFPA 90B-1993.

.2 Multi-layered insulation: staggered butt joints and expansion joints in insulation, secured with wire or bands at 400 mm on centre intervals.

.3 Insulation at bolts, studs, nuts, instrumentation: bevel to permit removal without damage to insulation or finish.

3.2 Installation (General) (Cont'd)

.4 Fastenings: glue insulation with minimum 50% coverage and secure in place with stainless steel wire/aluminum bands at 900 mm on centre before application of jacket.

.5 Finishes:

.1 Metal jacket:

.1 Apply over insulation in lieu of cement finish where specified.

.2 Pull up tight. Provide 25 mm overlap and secure.

.2 Final surface: to be clean and smooth.

3.3 Insulated Jacket

.1 As per manufacturers recommendations and to the satisfaction of the Engineer.

3.4 Insulation Schedule

Application	Insulation Type	Insulation Thickness (mm)	Jacket
Breechings	E2	2 - 25mm layers	metal
Air Seperators	Insulated Enclosure		
Generator Exhaust	E1	2 - 25mm layers	metal

END

PART 1 - GENERAL

1.1 References

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.2 ASTM C 177-85(1993), Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.3 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials and Assemblies.

.4 CAN/CGSB-51.10-92, Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.

.5 CAN/CGSB-51.11-92, Thermal Insulation, Mineral Fibre, Blanket, for Piping, Ducting, Machinery and Boilers.

.6 ANSI/NFPA 90A-1993, Installation of Air Conditioning and Ventilating Systems.

.7 ANSI/NFPA 90B-1993, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Provide shop drawings as follows:
- .1 Accoustic Lining.
- .2 Sealant.

PART 2 - PRODUCTS

2.1 Duct Liner

.1 General:

.1 Fibrous glass duct liner: air stream side faced with mat facing and edge coating.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102-M88.

.3 Suitable for velocities to 1829 mpm.

.4 Mold growth: to ASTM C665, G21, G22 will not support mold growth.

.5 Water vapour sorption: less than 3% weight to ASTM C1104.

.2 Flexible:

.1 To CAN/CGSB-51.11-92 and CAN 4-S102, fibrous glass blanket duct liner.

.2 Density: 24 kg/m^3 minimum.

.3 Thermal resistance to be minimum 0.70 W/m. deg.C for 25 mm thickness when tested in accordance with ASTM C 177-85(1993), at 24 deg.C mean temperature.

.4 Acceptable Material: Knauf Liner EM.

2.2 Adhesive

.1 Meet requirements of ANSI/NFPA 90A-1993 and ANSI/NFPA 90B-1993.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29°C to plus 93°C.

2.3 Fasteners

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

2.4 Joint Tape

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

2.5 Sealer

.1 Meet requirements of ANSI/NFPA 90A-1993 and ANSI/NFPA 90B-1993.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 deg.C to plus 93 deg.C.

2.6 Solid and Perforated Lining Metal Lining

.1 22 gauge perforated with 3mm hole staggered or solid galvanized sheet metal liner as indicated.

PART 3 - EXECUTION

3.1 General

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Lining thickness and features indicated in schedule.

.3 Provide lining for utility fan ducts as follows:

.1 Utility fan discharges full length from fan, BDD or control damper to hood/louvre or as indicated for the following:

.1 SF-1: full length

.2 EF-1: for full length from fan discharge to hood.

.2 All utility fan inlets unless otherwise noted: From 2000mm upstream of fan to fan inlet or as indicated:

.1 SF-1: full length

.4 Provide lining for air system ducts as follows:

.1 AS 1 and 2 S/A: From fan discharge until as indicated on drawings.

.2 AS 1 and 2 R/A: From fan inlet until as indicated on drawings.

.3 AS 1/2 O/A: For full length from hood/louvre to units.

.4 AS 1 E/A: For full length from hood/louvre to units.

3.1 General (Cont'd)

.4 (Cont'd)
.5 Generator O/A and E/A: For full length from hood/louvre to units.

.5 Provide lining on utility ducts as follows:
.1 Full length of boiler room combustion air.

.6 Duct dimensions, as indicated, are clear inside duct lining.

3.2 Duct Liner

.1 Install in accordance with manufacturer's recommendations, and as follows:

.2 General ducts:
.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

3.3 Joints

.1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
.1 Bed tape in sealer.
.2 Apply 2 coats of sealer over tape.

.2 Replace badly damaged areas of liner at discretion of Engineer.

.3 Protect leading and trailing edges of each duct section with two coats sealer lapped minimum 50mm onto duct.

3.4 Solid/Perforated Metal Lining

.1 Provide internal metal liners as follows:
.1 All acoustically lined round ducts.
.2 AS 1 rectangular S/A:
.1 For full length of acoustic lining.
.3 AS 2 rectangular S/A:
.1 For minimum 2000mm length of acoustic lining.

3.4 Solid/Perforated Metal Lining (Cont'd)

.1 (Cont'd)

.3 AS 2 rectangular S/A: (Cont'd)

.1 (Cont'd)

3.5 Lining Schedule

Application	Duct Type	Lining Type	Lining Thick (mm)	Liner
AS 1/2 S/A	Rect	Flexible	25	As spec
	Round	Flexible	25	Perf
AS 1 R/A	Rect	Flexible	25	As spec
AS 1 O/A	Rect	Flexible	50	No
AS 1 E/A	Rect	Flexible	50	No
AS 2 O/A	Rect	Flexible	25	No
EF E/A	Either	Flexible	25	As spec
S/A(General)	Either	Flexible	19	As spec
R/A(General)	Either	Flexible	19	As spec
Generator O/A	Either	Flexible	25	No
Generator E/A	Either	Flexible	25	No
Boiler C/A	Either	Flexible	25	No
Mech clg O/A	Either	Flexible	25	No
Mech clg R/A	Either	Flexible	25	No
Mech clg S/A	Either	Flexible	25	No

END

PART 1 - GENERAL

1.1 References
.1 ANSI/NFPA 10-1994, Portable Fire Extinguishers.
.2 CAN/ULC-S508-M90, Rating and Fire Testing of Fire Extinguishers.

1.2 Shop Drawings and Product Data
.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.
.2 Provide shop drawings as follows:
.1 All FE.

1.3 Maintenance Data
.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 Multi-Purpose Dry Chemical Extinguishers
.1 Pressurized type with shut-off nozzle, ULC labeled for A, B and C class protection. Size as noted.
.1 DCE-1: Type ABC, 2.5 kg.
.2 DCE-2: Type ABC, 4.5 kg.
.2 Acceptable material: Flag.

2.2 Extinguisher Brackets
.1 Wall mounted bracket as type recommended by extinguisher manufacturer.

2.3 Identification
.1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10-1994.
.2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 3 - EXECUTION

3.1 Installation .1 Install extinguishers on extinguisher brackets unless otherwise noted as indicated and as required by ANSI/NFPA 10-1994 and the Office of the NU Fire Marshall.

END

PART 1 - GENERAL

NOT USED

PART 2 - PRODUCTS

2.1 Exteior DWV Pipe Insulation

.1 Insulation:
- .1 Rigid closed cell polyurethane insulation, formed, 50 mm min thickness.
- .2 Properties:
  - .1 Water absorption: 4% by volume.
  - .2 Density: 35-46kg/m3.
  - .3 Compressive strength: 206kPa.
  - .4 Thermal conductivity: 0.020 to 0.026 W/m-degC.
  - .5 Operating temperatures: -45 to 120degC.

.2 Polymer Coating:
- .1 Two component, fully bonded polymer coating on all exterior surfaces.
- .2 Properties:
  - .1 Density: 1170kg/m3.
  - .2 Thickness: 1.6mm outside surfaces, 0.51mm inside surfaces.
- .3 Acceptable material: Urecon BL-75-20EP.

.3 Acceptable material: Urecon.

2.2 Heat Shrink

.1 Heat shrink sleeves: One piece cross-linked polyethylene.
- .1 Standard of Acceptance: Canusa.

.2 Heat shrinkable tape: 150 mm wide.
- .1 Standard of Acceptance: Raychem Thermaclad.

2.3 Jackets

.1 Aluminum:

.1 Apply in accordance with CSA HA Series M1980.

.2 Smooth finish, gloss finish jacketing 0.6 mm thick with longitudinal slip joints and 50 mm end laps. Aluminum alloy straps with mechanical fasteners.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, and appurtenances of accumulated debris and water before installation.

3.2 Installation Pipe Insulation Kits

.1 Insulation half shells:

.1 Installation: stainless steel straps and clips with silicone caulking at seams.

.2 Heat shrink: install heat shrinkable tape in 2 layers. Overlap tape a minimum of 50%. Apply and shrink the first layer before applying the second.

3.3 Coordination

.1 Coordinate installation of insulation and jacket with Div 16 installation of piping heat trace.

3.4 Jackets

.1 Apply over insulation for full length of installation.

.2 Pull up tight. Provide 25 mm overlap and secure.

.3 Final surface: to be clean and smooth.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/ASME B16.15-1985, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI B16.18-1984, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI B16.22-1980, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.4 ANSI B16.24-1979, Bronze Pipe Flanges and Fittings, Class 150 and 300.

.5 ASTM A 307-94, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.6 ASTM B 88M-93a, Specification for Seamless Copper Water Tube (Metric).

.7 MSS-SP-80-1979, Bronze Gate, Globe, Angle and Check Valves.

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Submit data for following:
.1 Valves.
.2 Mechanical Joints.

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 Domestic Water Piping

.1 Tank Fill and Vent: copper tube, hard drawn, Type M: to ASTM B 88M-93a.

.2 General Piping: copper tube, hard drawn, Type K or L: to ASTM B 88M-93a.

.3 Concealed: flexible PEX-AL-PEX tubing to to CSA B137.10 and ASTM F1281. ANSI/NSF standard 61 for potable water.
- .1 Operating temperature: to 99degC
- .2 Operating pressure: 793kPa
- .3 Acceptable material: Kitec Orange

2.2 Domestic Water Fittings

.1 Concealed:

.1 Brass crimp fitting to CSA B137.9 with double o-ring seal.
- .1 Acceptable material: Kitec

.2 General and Tank Fill and Vent:

.1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15-1985.

.2 Cast copper, solder type: to ANSI B16.18-1984.

.3 Wrought copper and copper alloy, solder type: to ANSI B16.22.

.4 Wrought copper, grooved fittings to ASTM B 75-93 and ANSI B16.22.

2.3 Domestic Water Joints

.1 General:

.1 Lead free solder.

.2 Teflon tape for threaded joints.

.2 Grooved fittings:

.1 Rigid grooved joint with EPDM gasket, Acceptable Material: Grinnell Fig 7400 Rigidlite.

2.4 Check Valves (Horizontal)

.1 To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat, screwed.
.1 Acceptable material: Kitz Fig 22/Toyo.

2.5 Check Valves (Vertical)

.1 Class 125, 860 kPa, bronze body, bronze disc, lift type, vertical way, screwed ends.
.1 Acceptable material: Kitz Fig 26/Toyo.

2.6 Ball Valves

.1 Class 600, bronze body, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.
.1 Acceptable material: Kitz Fig 68/Toyo.

2.7 Drain Valves

.1 As per Section 15010.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with Canadian Plumbing Code - 1995.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble all piping using fittings manufactured to ANSI standards.

.4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.

.6 Lay tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.

3.1 Installation (Cont'd)

.7 Copper fixture supply pipes shall be secured to proper backing in the walls with wing back 90 degree elbows.

.8 Install flanges or unions and isolation valves to permit removal of equipment without disturbing piping systems, as required by sizing standard.

.9 Install pipetite bushings where piping passes through steel studs.

.10 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

3.2 Valves

.1 Isolate equipment, fixtures and branches with ball isolation valves.

.2 All valves to be specified ball valves. Where gate valves indicated on drawings provide ball valves.

3.3 Domestic Water System Flushing & Disinfection

.1 Complete all leakage tests before flushing and disinfection.

.2 Flush all potable water pipes and tanks thoroughly before disinfection. Flush for a minimum of 30 minutes so that all deleterious material is removed.

.3 Supply materials and test kit to carry out disinfection as follows:

.1 Fill piping system and tanks with chlorine/water solution with a strength of at least 50 mg/L. Ensure pipe is full and no air pockets remain.

.2 Leave solution in piping system for 24 hours, while maintaining a pressure of 175 kPa.

.3 After 24 hours sample and test the chlorine solution. If the chlorine residual is at least 25 mg/L, the disinfection will be considered successful. Flush chlorine solution from the system. Protect against contamination of the disinfected system.

3.3 Domestic Water System Flushing & Disinfection (Cont'd)

.4 If the chlorine residual is less than 25 mg/L, flush the system, clean any deleterious material, re-flush and disinfect again. Repeat until satisfactory.

.5 If, in the opinion of the Engineer, any component of the potable water system becomes contaminated after disinfection, it shall be flushed and disinfected again at no additional cost.

.6 Obtain 3 water samples, one from truck fill, one from tank after fill and one from water piping. Test in approved laboratory for bacteriological analysis and provide certifcation that all samples are suitable for human consumption prior to interim-occupancy inspection.

END

PART 1 - GENERAL

1.1 References

.1 ASTM B 32-95, Specification for Solder Metal.

.2 ASTM B 306-92, Specification for Copper Drainage Tube (DWV).

.3 ASTM C 564-95, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.4 CSA B67-1972, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.5 CAN/CSA-B70-M91, Cast Iron Soil Pipe, Fittings and Means of Joining.

.6 CSA B125-93, Plumbing Fittings.

PART 2 - PRODUCTS

2.1 Cast Iron Piping and Fittings

.1 Sanitary waste and vent: to CAN/CSA-B70-M91.

.1 Joints.

.1 Mechanical joints with:

.1 Neoprene compression gaskets with stainless steel clamps.

PART 3 - EXECUTION

3.1 General

.1 Use of cast iron/copper DWV piping is mandatory for the following locations:

.1 DWV vent through roof for min 1500 mm to roof penetration and through roof.

.2 All electric and hydronic heat traced piping.

.3 All buried building DWV piping.

3.2 Installation

.1 Install in accordance with Canadian Plumbing Code - 1995.

3.2 Installation (Cont'd)

.2 Install piping parallel and close to walls to conserve headroom and space, and grade as indicated as per CPC.

3.3 Buried Piping Insulation and Heat Tracing

.1 All below slab piping to be insulated for full length of piping. Insulation to be continuous and field installed to manufacturers recommedations.

.2 All below piping to be complete with hydronic heat trace. Provide at a minimum a single pass of heat trace on each piping branch. Heat trace to be located between 4 and 8 o'clock positions of the pipe.

END

PART 1 - GENERAL

1.1 References

.1 ASTM D 2564-93, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Pipe and Fittings.

.2 CAN/CSA-B181.2-M90, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CSA B181.12-1967, Recommended Practice for the Installation of PVC Drain, Waste and Vent Pipe and Pipe Fittings.

PART 2 - PRODUCTS

2.1 Piping and Fittings

.1 For above ground:

.1 Certified PVC to CSA B181.2-M90 listed for use in noncombustible construction, ULC listed to CAN4-S102.2, flame spread rating maximum 15.

.1 Acceptable material: IPEX System 15 PVC-DWV.

2.2 Joints

.1 Solvent weld for PVC: to ASTM D 2564-93.

2.3 PVC Intumescent Coating

.1 Latex based, intumescent coating, Flame spread=0, smoke developed rating=35, impervious coating, UV and condensation resistant, minmimum bonding strength to 2775kPa to ASTM standards. Performance to ULCS102.2, ITS/Warnock Hersey Underwriter Approval.

.2 Factory coated with field touch up as requried.

.3 Acceptable material: Ipex FR Coating

PART 3 - EXECUTION

3.1 General

.1 Listed PVC DWV piping and fittings acceptable throughout building except as follows:
.1 Use in Vertical Shafts as defined by NBCC not acceptable.
.2 DWV vent through roof for min 1500 mm to roof penetration and through roof.
.3 All electric and hydronic heat traced piping.
.4 All exterior and buried building DWV piping.

.2 For PVC DWV piping in rated ceiling plenums provide factory applied listed intumescent fire retardant for full length of piping.

3.2 Installation

.1 Install in accordance with National Plumbing Code and to following standards.

.2 Install PVC drain, waste and vent pipe and pipe fittings in accordance with CSA B181.12 and to the manufacturers listings.

.3 Install piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.4 Provide specified fire stopping systems for piping thru fire rated walls and floors where required.

END

PART 1 - GENERAL

1.1 References

.1 ASTM A 126-93, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B 62-93, Specification for Composition Bronze or Ounce Metal Castings.

.3 ANSI/AWWA C700-95, Cold Water Meters-Displacement Type.

.4 B79-94, Floor Drains and Trench Drains.

.5 PDI-WH201-77, Water Hammer Arrestors.

1.2 Submittals

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate dimensions, construction details and materials for the following: floor drains,

.1 Floor drains.
.2 Cleanouts.
.3 Hose bibbs.
.4 Strainers.
.5 Expansion tanks.
.6 Water hammer arrestors.
.7 Vent flashings.
.8 DW backflow preventor.
.9 Trap seal primers
.10 Eyewash station

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
.2 Details of operation, servicing and maintenance.
.3 Recommended spare parts list.

PART 2 - PRODUCTS

2.1 Floor Drains

.1 Floor drains: to B79-94.

.2 Type 1: general duty; cast iron body round adjustable head, flanged strainer, integral seepage pan suitable for installation in concrete deck.
.1 Acceptable material: Smith Series xxxx.

.3 Type 2: general duty; cast iron body round adjustable head, flanged strainer, integral seepage pan suitable for installation in concrete deck with duco cast iron 100dia funnel

.1 Acceptable material: Smith Series xxxxx with Fig 3580 funnel.

2.2 Cleanouts

.1 Wall Access Cleanout Covers:
.1 Access Covers: face of wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs .

.2 Floor Access Cleanouts: heavy cast iron epoxy coated, MJ, brass screws, round cover, adjustable collar, cover to suit finished flooring, nickel bronze finish, ABS plug.

.3 Acceptable material: Smith.

2.3 Water Hammer Arrestors

.1 Stainless steel construction, bellows type: to PDI-WH 201.

.2 Acceptable material: Smith Hydrotorol.

2.4 Hose Bibbs

.1 Type 1: CSA approved, 19 dia. brass construction complete with integral vacuum breaker, hose thread spout, replaceable composition disc.
.1 Acceptable material: Acorn 8136.

2.5 Strainers	.1	1035 kPa, Y type with 20 mesh, stainless steel removable screen, bronze body screwed cap, threaded ends.
	.2	Acceptable material: Kitz, Toyo.
2.6 Vent Flashings	.1	Copper, pre-insulated stack jack.
	.2	Acceptable material: Thaler SJ-8. This is the only acceptable material.
2.7 DHW Diaphragm Type Expansion Tanks	.1	Cylindrical steel pressurized diaphragm type expansion tank.
	.2	Capacity: min total volume 8L.
	.3	Diaphragm sealed butyl suitable for potable water.
	.4	Working pressure: 1035 kPa.
	.5	Air precharged to 276 kPa.
	.6	Acceptable material: Amtrol Therm-X-Trol.
2.8 Backflow Preventor (Hosebibbs)	.1	Continuous pressure, rough brass, CSA approved, line size.
	.2	Acceptable Material: Conbraco 40-400 Series.
2.9 Backflow Preventor (Polymer Tank)	.1	Reduced pressure, bronze, CSA approved, line size, with strainer and isolation valves, rated to 1200kPa and operating temperatures between 0.5degC to 82degC.
	.2	Acceptable material: Conbraco 40-200 Series.

2.9 Trap Seal Primer

.1 All bronze with integral vacuum breaker, 13 dia solder ends, 13 dia. drip line connector.

.2 Acceptable material: Enpoco TSP.

2.10 Eyewash Station

.1 Gravity fed self contained eyewash station, high visibility polyehtylene tank with contrasting tray and minimum 15 minute flush to CSA/ANSI Z358.1, corrosion resistant ABS dual stream eyewash heads and pinch valve complete with minimum one year supply of bacteriostatic additive, wall mounted.

.2 Mounting height: as per manufacturers recommendations.

.3 Acceptable material: Encon 01104050/Haws

2.11 Non-Potable Water Pressure Tank

.1 Steel tank, urethane finish, butyl diaphragm, 360deg mechanical seal, non metallic rigid polypropylene liner.

.2 ASME Rated to 860kPa.

.3 Capacity: total 166L, drawdown (30/50)=51.5L.

.4 Acceptable material: Amtrol Well-X-Trol Model 250.

2.12 Non-Potable Water Filter

.1 Cartridge cluster filter.

.2 Filter quantity: 7

.3 Connection: 38dia NPT.

.4 Rate pressure: 1030kPa.

.5 Rated flow: 114L/min.

.6 Filtration efficiency: 25 micron.

.6 Acceptable material: SAI-F-7-304SS

PART 3 - EXECUTION

3.1 Installation	.1	Install in accordance with National Plumbing Code of Canada-1995 and as noted on drawings.
	.2	Install in accordance with manufacturer's instructions and as specified.
3.2 Cleanouts	.1	In addition to those required by code, and as indicated, install at base of all soil and waste stacks.
	.2	Bring cleanouts to wall or finished floor unless serviceable from below floor.
	.3	Stack base cleanouts to line size up to maximum 100 dia.
3.3 Water Hammer Arrestors	.1	Install on branch supplies to group of fixtures where indicated. Provide line size ball isolation valves.
3.4 Hose Bibbs	.1	Install at 1200 AFF where indicated on drawings.
3.5 Strainers	.1	Install with sufficient room to remove basket.
3.6 Plumbing Vent	.1	Coordinate with roof flashings and install as per manufacturers recommendations.
3.7 DHW Expansion Tank	.1	Install as per manufacturers directions and as indicated.

3.8 Floor Drains

.1 Install with flange countersunk in floor 1 mm below floor level. Caulk perimeter prior to installing.

.2 Finished flooring to cover flange and butt up to strainer.

.3 Connect to specified TSP as specified.

3.9 Trap Seal Primer

.1 Install on cold water piping as indicated or required at nearest fixture in concealed space or provide direct connection to DCW piping with ball isolation valve.

.2 Connect with line size Type L flexible copper tubing or rigid tubing.

.3 Provide trap seal primer for all FD locations.

3.10 Start Up

.1 After start-up, test, adjust and prove operation as indicated, to suit site conditions such as:

.1 Clean out strainers periodically until clear.

.2 Clean out and prime all floor drain traps using trap seal primers or other means acceptable to the National Plumbing Code.

.3 Test freedom of movement of cleanouts.

END

PART 1 - GENERAL

1.1 References

.1 CGSB 41-GP-22, Standard for Process Equipment: Reinforced - Polyester Chemical Resistant, Custom Contact Moulded.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 15010.

.2 Indicate dimensions, capacities, fabrication details, connection details, pressure ratings, finishes and mounting details.

.3 Shop drawings to be complete with professional engineers seal affixed verifying design of tanks.

.4 Shop drawings to be prepared using AUTOCADD 2000 or R14 or approved equal.

PART 2 - PRODUCTS

2.1 DW Water Tanks (Sandwich Const)

.1 General: sandwich construction FRP tank to CAN/CGSB-41.22-93 for potable water.

.2 Manufacturer Total Quality System: Tank manufacturer to have current ISO 9002 Quality Certification.

.3 Mounting: self supporting, base mounted.

.4 Minimum working pressure: 172 kPa.

.5 Fabrication: sandwich construction formed
.1 Internal finish: FDA approved gelcoat suitable for potable water applications.
.2 Internal lamination: 3mm gun applied chop strand laminate, polyester resin.
.3 Core:
.1 Top: 13mm Tricell or as per other.
.2 Other: 16mm GIS fire plywood.
.4 External lamination: 3mm gun applied chop strand laminate, polyester resin.

2.1 DW Water Tanks (Sandwich Const) (Cont'd)

.5 Fabrication: (Cont'd)
.5 External finish: UV resistant gelcoat finish.
.6 Reinforcing: directional structural glass, handlayup, polyester resin.

.6 Access manholes: 600dia flanged side or top access manhole. Manhole to be flange mounted with stainless steel bolts and reusable gasket.

.7 Sectional joints: Not acceptable.

.8 Piping Connections: Flange type, flange face to ANSI B16.3. Size and location as noted on drawings. **Use of bulkhead fittings is not acceptable.**

.9 Warranty: Two years on material and workmanship.

.10 Tank dimensions and capacities: Nominal tank dimensions and capacities as per drawings.

.11 Acceptable Material: Carlson Structural Glass

2.2 Non Potable Water Tank

.1 1137 L self supporting molded polyethelyne tank suitable for potable water, c/w top access manhole, fittings as shown on drawing.

.2 Connection by bulkhead fittings as required.

.3 Fabricate to requirements of CGSB41-GP-22.

.4 Acceptable material: Equinox Model E250.

PART 3 - EXECUTION

3.1 Tanks

.1 Installation and securing of tanks to be to manufacturers recommendations.

END

PART 1 - GENERAL

1.1 References	.1	CAN/CSA-B45 Series-94 Series-88, CSA Standards on Plumbing Fixtures.
	.2	CSA B125-93, Plumbing Fittings.
1.2 Product Data	.1	Submit product data in accordance with Section 01300 - Submittals.
	.2	Indicate: dimensions, construction details and roughing-in dimensions for all fixtures and trim.
1.3 Maintenance Data	.1	Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.
	.2	Data to include: .1 Description of plumbing fixtures and trim giving manufacturers name, type, model, year and capacity. .2 Details of operation, servicing and maintenance. .3 Recommended spare parts list.
1.4 Fixtures and Trim	.1	Manufacture plumbing fixtures in accordance with CAN/CSA-B45 Series-94 Series.
	.2	Manufacture plumbing fittings in accordance with CSA B125-93.
	.3	Architectural drawings to govern in determination of number and location of fixtures.
	.4	Fixtures of same service to be product of one manufacturer and of same type.
	.5	Trim of same service to be product of one manufacturer and of same type.
	.6	Exposed plumbing brass to be chrome plated.

PART 2 - PRODUCTS

2.1 Water Closets

.1 WC-1:

1. Rear discharege, wall mounted vitrous china, siphon jet, with elongated rim, self-draining, low volume (13L) flush tank, check drip tank.
   .1 Acceptable material: American Standard

.2 Macerator lift station: suitable for concealed mounting,
.1 Maximum entering temperature 50degC.
.2 Capacity: 32 lpm, 4 meters head.
.3 Motor: fract kw 110/1ph/60hz.
.4 Acceptable Material: Sanitary for All Ltd. Sanipak

.3 Seat: white open front molded solid plastic less cover, with stainless steel check hinge and stainless steel or solid brass insert post.
   .1 Acceptable Material: Olsonite Model 95.

2.2 Lavatories

.1 L-1:
.1 Bowl: vitreous china, cantilever, front overflow, space savings, extra heavy back, inward slanting top surface, 102mm centers.
   .1 Acceptable material: Crane Spruce Cove Model 1-154.
.2 Trim: cast brass, 200mm tubular swing spout, flow control vandal proof aerator 70mm lever handle, w/ sanitary hood.
   .1 Acceptable material: Cambridge Brass2 26T233.
.3 Waste: integral stainless steel basket strainer/stopper, tailpiece, chrome plated cast brass trap and cleanout.
   .1 Acceptable material: Cambridge Brass 33T360.

2.3 Fixture Supplies

.1 Exposed fixtures: Chrome plated flexible fixture supplies with screwdriver stops, reducers and escutcheons on each service to each fixture.
.1 Acceptable material: Cambridge Brass.

PART 3 - EXECUTION

3.1 Fixture Installation

.1 Connect fixtures complete with supplies and drains, trapped, supported level and square Hot water faucets shall be on left. Fixtures on outside walls to have supplies from floor; other fixtures to be served from wall. Wall hung fixtures to be securely and firmly mounted.

.2 Mounting heights for wall hung fixtures measured from finished floor:
.1 Standard: to comply with manufacturers roughing-in details unless otherwise indicated or specified.

.3 Fixtures shall be serviced as follows:

Fixture	Waste (mm)	Vent (mm)	CW (mm)	HW (mm)
Lavatory	32	38	13	13
Water Closet	75	38	13	
Floor Drains	100	-	-	-

3.2 Commissioning

.1 Flush valves: adjust settings to suit site conditions.

.2 Aerator screens and strainers: clean out.

3.3 Wall Hangers

.1 Provide wall hangers for all wall hung fixtures. Obtain approval from Engineer prior to covering structure.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 15010.

.2 Indicate:
.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
.2 Dimensions and recommended installation.
.3 Pump performance and efficiency curves.

PART 2 - PRODUCTS

2.1 Domestic Water Packaged Pressure Pump

.1 Pump:
.1 Dual stage shallow well centrifugal pump.
.2 Capacity: 1514 l/hr @ 345 kPa.
.3 Construction: stainless steel shaft, bronze impellers, viton shaft seal, epoxy coated cast iron body.
.4 Motor: 0.37 kW/120V/1ph/60Hz with automatic overload protection.

.2 Tank:
.1 Construction: steel tank, urethane finish, butyl diaphragm, 360° mechanical seal, non metallic rigid polypropylene liner.
.2 Capacity: total = 50L

.3 Control:
.1 Diphragm pressure switch, spst, adjustable differential, factory setting 207-345kPa, 120V.

.4 Pressure gauge: range to max 690kPa

.5 Mounting: horizontal mounted unit with pump mounted on tank.

.6 Acceptable Material: Myers Model HJ50S-TH13 pump package.

2.2 Spray Wash Pressure Pump (Non potable)

.1 Dual stage shallow well centrifugal pump.

.2 Construction: stainless steel shaft, bronze impellers, viton shaft seal, epoxy coated cast iron body.

.3 Capacity: 151 l/min @ 379 kPa.

.4 Motor: 1.5 kW/230V/1ph/60Hz with automatic overload protection.

.5 Acceptable Material: Myers Model IHCM 200.

2.3 Lift Station Sump Pump

.1 Pumps:

FM listed for Class 1, Groups C and D, non-clog submersible, recessed vortex impeller, suitable for handling 50mm diameter solids.

.2 Discharge flange: 50dia.

.3 Motor: sealed submersible type, stator winding Class F insulation, high dielectric cooling and lubrication oil, dual heavy duty ball bearings minimum 50,000 hours B10 life, heat shrunk stator into motor housing. Auto reset heat operated thermostat in winding in series with starter.

.4 Seals: dual mechanical seals in tandem seal chamber, oil filled.

.5 Impeller: cast ductile iron, 2 vane non clogging enclossed, rounded tips, dynamically balanced, stainless steel shaft with lock screw.

.6 Case: cast iron, flanged centerline discharge, non rotating bronze wear ring with set screw.

.7 End Cap: upper motor bearing cap seperate casting for easy mounting and replacment.

.8 Power cables: double sealed, type SJOW/SJOWA insulation, carrier ground conductor.

.9 Capacities: 2.59L/s at 5.7m. Pumps to be non overloading.

Sump Pump (Cont'd)

.1 Pumps:(Cont'd)
.10 Electrical: 0.373kW, 230V/1ph/60Hz.

.2 Acceptable material:
.1 Pumps: Myers WHR5-21C

PART 3 - EXECUTION

3.1 Installation

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Confirm pump rotation and flow direciton are correct.

END

PART 1 - GENERAL

1.1 References

.1 ASTM A 53-90b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.2 ASTM B 61-93, Specification for Steam or Valve Bronze Castings.

.3 CAN/CSA-B139-M91, Installation Code for Oil Burning Equipment.

.4 MSS-SP-80-1987, Bronze Gate, Globe, Angle and Check Valves.

.5 CAN/CSA-B140.0-M87, General Requirements for Oil Burning Equipment.

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Indicate on manufacturers catalogue literature the following:

.1 Valves.
.2 Filters.
.3 Tank trim.
.4 Pumps.
.5 OSV Valves.

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 Pipe

.1 Steel: to ASTM A 53-90b, Schedule 40, continuous weld or ERW.

2.2 Fittings

.1 Steel:
.1 Malleable iron: screwed, banded, Class 150 to ANSI/ASME B16.3-1992. .
.2 Steel: butt-welding.
.3 Unions: 300 Class malleable iron, brass to iron, ground seat, screwed, to ASTM A 47M-90.
.4 Nipples: Schedule 40, to ASTM A 53-90b.

2.3 Jointing Material and Method

.1 General: screwed fittings: jointing compound.

.2 Finished architectural spaces: welded as per Section 15061.

2.4 Ball Valves (Interior)

.1 Class 600 WOG, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.
.1 Acceptable material: Kitz Fig 68/Toyo.

2.5 Ball Valves (Exteior)

.1 Low temperature suitable for operating temperatures to -40degC, Class 600 WOG, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.
.1 Acceptable material: Kitz Fig 68A/Toyo.

2.6 Drain Valves

.1 Minimum 13dia, class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.
.1 Acceptable material: Kitz /Toyo.

2.6 Drain Valves (Cont'd)	.1	(Cont'd) .1 Acceptable material:(Cont'd)
2.7 Swing Check Valves	.1	To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, Y pattern, screw in cap, screwed. .1 Acceptable material: Kitz Fig 22/Toyo.
2.8 Strainers	.1	1035 kPa, Y type with 20 mesh stainless steel removable screen bronze body screwed cap, threaded ends. .1 Acceptable material: Kitz Fig 15/Toyo.
2.9 Level Gauging	.1	Level gauging to meet ULC/FM requirements for hazardous liquids.
	.2	Auxillary Tank: tank mounted float type. .1 Acceptable material: General Filters Model GFUL-100.
	.3	Main Tank: pneumatic operated wall mounted levelometer, suitable for tanks of up to 34m3 capacity c/w require tubing busings and air bell assembly. .1 Acceptable material: Hersey Products Large Model
2.10 Boiler Oil Filters	.1	Acceptable material: General Filters 2A-700A.
2.11 Vent Cap	.1	Acceptable material: Firomatic Fig No 4024.

2.12 Fusible Link Valve

.1 Acceptable material: Firomatic.

2.13 Fuel Oil Transfer Pumps

.1 Capacity: 11.4 L/min @ 345 kPa and 10in Hg.

.2 Construction: base mounted direct drive, self lubricating, ball bearings, mechanical seals, rated to 1725 kPa with integral relief valve set at 135kPa.

.3 Motor 0.197 kW, 120V/1ph/60Hz.

.4 Acceptable material: Viking Model FH182.

.5 This is the only acceptable material.

2.14 OSV Valves

.1 Minimum rated capacity 225L/hr at 34kPa inlet prssure, required rated capacity 118L/hr, 13dia port, UL listed, spring operator.

.2 Acceptable material: Webster OSVA 50.

2.15 Drip Pans

.1 Welded steel min 12ga liquid tight with minimum 25mm high sides.

.2 Min dimensions: 300x300.

PART 3 - EXECUTION

3.1 Piping

.1 Install oil piping in accordance with CAN/CSA-B139-M91 and CAN/CSA-B139-M91.

.2 Assemble piping using fittings manufactured to ANSI standards. Provide threaded fittings except in locations as follows. For these locations provide welded fittings:
.1 Finished architectural interior spaces except mechanical and electrical service rooms.

3.1 Piping (Cont'd)

.2 (Cont'd)
.2 All piping located in closed utilidors or joist spaces.

.3 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.4 Slope piping down in direction of storage tank unless otherwise indicated.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage.

.6 Provide clearance for installation of insulation and access and maintenance of equipment, valves and fittings.

.7 Ream pipes, clean scale and dirt, inside and out.

3.2 Valves

.1 Install valves with stems upright or horizontal unless approved otherwise by Engineer.

.2 Install ball valves at all branch take-offs, to isolate each piece of equipment and as indicated.

.3 Install swing check valves and as indicated.

3.3 Pumps

.1 Ensure that pump body does not support piping or equipment.

.2 Install on housekeeping pad as per details.

3.4 Level Gauging

.1 Provide leak and vapour proof connections.

.2 Calibrate system.

3.5 Testing	.1	Reference section 15011.
3.6 Flushing and Cleaning	.1	Flush after pressure test with number 2 fuel oil for a minimum of 2 h. Clean strainers and filters.
3.7 Drip Pans	.1	Provide for all fuel oil filters.

END

PART 1 - GENERAL

1.1 References

.1 American National Standards Institute (ANSI).
.1 ANSI/ASME B16.5-1988, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
.2 ANSI B18.2.1-1981(R1992), Square and Hex Bolts and Screws.

.2 American Society for Testing and Materials (ASTM).
.1 ASTM A 53-90b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

PART 2 - PRODUCTS

2.1 Pipe

.1 Steel pipe: schedule 40 to ASTM A 53-90b, Grade B.

2.2 Pipe Joints

.1 63 dia. and over: welding fittings and flanges to CSA W47.1-92.

.2 Flanges: plain or raised face, slip-on or weld neck.

.3 Flange gaskets: high temp suitable for tail pipe exhaust systems.

.4 Bolts and nuts: to ANSI B18.2.1-1981(R1992).

2.3 Fittings

.1 Pipe flanges and flanged fittings:
.1 Steel: to ANSI B16.5.

.2 Steel butt-welding fittings to ASTM A 234/A 234M-94 and ANSI B36.10.

PART 3 - EXECUTION

3.1 Piping Installation

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Slope piping at 1:100 in direction of muffler flow for drainage and positive venting.

.3 Provide clearance for installation of insulation and access for maintenance of equipment.

.4 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

.5 Assemble piping using fittings manufactured to ANSI standards.

END

PART 1 - GENERAL

1.1 Pre-Purchased Equipment

.1 Items specified in this Section have been pre-purchased and will be delivered FOB, Pangnirtung, NU. For additional responsibilities not specified in this Section including unload and warranties refer to Section 01110.

.2 Receive equipment F.O.B. and store and process the equipment until installation.

1.2 Shop Drawings and Product Data

.1 The equipment specifications for the pre-purchased items are included at the end of the project specification, printed on blue paper for confirmation only. The following shop drawings are provided:

.1 Raw Sewage Lift Pumps P1 and P2.
.2 Screened Sewage Lift Pumps P3 and P4.
.3 Screen and Compactor.
.4 Main Feed Pumps P5 and P6.
.5 Sludge Pumps P7 thru P10.
.6 Scum Pumps P11 thru P14.
.7 Sludge Bagger Pump and Polymer Feed Package.
.8 Sludge Bagger.
.9 Filtrate Return Pump P16
.10 Equalization Tank Blowers BL1 and BL2.
.11 Sludge Tank Blowers BL1 and BL2.

PART 2 - PRODUCTS

2.1 Raw and Screened Sewage Lift Pumps P1 thru P4

.1 Pumps:
.1 Submersible sewage pump, 75mm solids handling capability.
.2 Capacity: 284 l/min @ 11.9m.
.3 Motor: 1.5 kW/600V/3ph/60Hz.

.2 Specified product: Goulds Pumps Series 3SD.

2.2 Raw and Screened Sewage Tank

.1 Tank:
.1 Shop fabricated, aluminum construction, 10dia Kitec hydronic heat trace, insulated.
.2 Auxiliary electric heat trace.
.3 Slide rail mounting plates.
.4 Hinged pump service access doors.
.5 Level switch and pump electrical connection junction boxes.
.6 Hydronic heat trace connection box with cover.
.7 Auxiliary electric heat trace junction box.
.8 Heat trace controller temperature transmitters.

.2 Dimensions: approx 2440x4880x1800depth internal dimensions.

.3 Shop drawings to be provided by BCA.

2.3 Screen and Compactor

.1 Screen:
.1 Shop fabricated medium duty internally fed uni-frame rotary screen.
.2 Motor: 0.37kW, 600V/3ph/60Hz.
.3 Specified product: IPEC Model IFU 3036

.2 Compactor:
.1 Shop fabricated screening conveyor/compactor. All stainless steel construction.
.2 Motor: 0.75KW, 600V/3ph/60Hz.
.3 Specified product: IPEC Screening/Conveyor Compactor.

2.4 Main Feed Pumps P5 and P6

.1 Pumps:
.1 End suction base mounted progressing cavity pump, steel base, flexible coupling with guard.
.2 Motor: 0.75 kW/600V/3ph/60Hz.

.2 Specified product: Eagle EP-67 CSQM

2.5 Sludge Pumps P7 thru P10

.1 Pumps:
.1 End suction base mounted progressing cavity pump, steel base, flexible coupling with guard.
.2 Motor: 0.37 kW/600V/3ph/60Hz.

.2 Specified product: Eagle EP-44 CSQM

2.6 Scum Pumps P11 thru P14

.1 Pumps:
.1 Submersible sump pumps.
.2 Motor: 0.37 kW/120V/1ph/60Hz.

.2 Shop drawings to be provided by BCA.

2.7 Sludge Bagger Pump and Polymer Feed Package

.1 Skid mounted polymer feed sub system with the following features:
.1 Polymer mixing tank.
.2 Polymer mixer.
.3 Eductor and Funnel Assembly.
.4 Polymer Feed Pump.
.5 Static Mixer Assembly.
.6 Polymer injection Ring
.7 Distribution manifold.
.8 Sludge Feed Pump.
.9 Control panel.

.2 Specified product: Envirodyme Systems Inc Model PFS-100

2.8 Sludge Bagger

.1 Manifold sludge bagger with the following features:
.1 Distribution hood.
.2 Quick opening bag holders.
.3 Overflow.
.4 Dewatering bag.
.5 Support cage.
.6 Filtrate pan.

.2 Specified product: Envirodyme Systems Inc Model SBS-12i

2.9 Filtrate Return Pump

.1 Packaged lift station c/w pump, level switch and sump.

.2 Shop drawings to be provided by BCA.

2.10 Equalization Tank Blowers BL1 and BL2

.1 Skid mounted air blower with the following features:
- .1 V-Belt drive.
- .2 Inlet filter/silencer.
- .3 Discharge silencer.
- .4 Check valve.
- .5 Relief valve.
- .6 Pressure gauge.
- .7 Fabricated steel base.

.2 Power: 5.6kW 600V/3ph/60Hz.

.3 Specified product: Specialty Equipment Package with Sutorbilt 4HV-P Blower.

2.11 Sludge Tank Blowers BL3 and BL4

.1 Skid mounted air blower with the following features:
- .1 V-Belt drive.
- .2 Inlet filter/silencer.
- .3 Discharge silencer.
- .4 Check valve.
- .5 Relief valve.
- .6 Pressure gauge.
- .7 Fabricated steel base.

.2 Power: 3.7kW 600V/3ph/60Hz.

.3 Specified product: Specialty Equipment Package with Sutorbilt 3MV-P Blower.

PART 3 - EXECUTION

3.1 Raw and Screened Sewage Lift Pumps

.1 Install on tank mounted slide rail to manufacturers recommendations.

.2 Confirm pump rotation and flow direction are correct.

3.2 Raw and Screened Sewage Tank

.1 Install tank in tank pit to structural and architectural details.

.2 During installation maintain pneumatic air test at 275kPa on hydronic heat trace piping throughout placement of tank in tank pit. If test pressure of 10kPa or greater is lost terminate tank placement. Establish air pressure and maintain for minimum 30min prior to recommencing tank placement. If test pressure cannot be maintained make good damage prior to continuing placement of tank.

.3 Ensure liquid tight joint at tank seal. See structural and architectural details.

.4 Use approved expanding foam insulation to seal void all around between tank and tank pit after installation.

.5 Install lift pump rails to manufacturers requirements using provided mounting plates.

.6 Install provided pump on/off and high alarm level switches using provided hangers.

.7 Make hydronic heat trace connections to building hydronic heating system as per plans and details.

.8 Provide all piping and misc connections as indicted on plans, details and schematics.

3.3 Screen and Compactor

.1 Install to manufacturers and BCA recommendations. Unit is supplied as a single unit on common base.

.2 Secure to tank/floor at indicated anchor locations. See structural/architectural drawings.

.3 Provide all piping and misc connections as indicted on plans, details and schematics.

.4 Provide for installation of separately shipped and packaged screen wash water solenoid control valves.

.5 Control panel and wiring specified under Division 16.

3.4 Main Feed Pumps P5 and P6

.1 Install securely on concrete housekeeping pads as indicated. Adjust height of pad to allow connection to Equalization tank suction without dips or high spots in piping.

.2 Pumps connections are NPT. Provide concentric reducer to line size flange at inlet and discharge for connection to piping.

.3 Ensure pump and motor assembly do not support piping.

.4 Allow for removal of pumps without disturbing fixed piping.

.5 Confirm pump rotation and flow direction are correct.

3.5 Sludge Pumps P7 thru P10

.1 Install securely on concrete housekeeping pads as indicated.

.2 Pumps connections are NPT. Provide concentric reducer to line size flange at inlet and discharge for connection to piping.

.3 Ensure pump and motor assembly do not support piping.

3.5 Sludge Pumps P7 thru P10 (Cont'd)	.4	Allow for removal of pumps without disturbing fixed piping.
	.5	Confirm pump rotation and flow direction are correct.
3.6 Scum Pumps P11 thru P14	.1	Install in clarifiers on pump stands provided in tank. Provide piping as per plans and schematics.
	.2	Allow for removal of pumps without disturbing fixed piping.
	.3	Confirm pump rotation and flow direction are correct.
3.7 Sludge Bagger Pump and Polymer Feed Package	.1	Install skid mounted on 100mm thickness concrete pad.
	.2	Install level and secure to pad.
	.3	Provide all piping and misc connections as indicated on plans, details and schematics.
3.8 Sludge Bagger	.1	Install to manufacturers and BCA recommendations. Unit is supplied as a single unit on common base.
	.2	Secure direct to floor at indicated anchor locations. See structural/architectural drawings.
	.3	Provide all piping and misc connections as indicated on plans, details and schematics.
3.9 Filtrate Return Pump	.1	Secure direct to floor at indicated locations. Piping from sludge bagger to filtrate return pump to be gravity feed to pump.
	.2	Provide all piping and misc connections as indicated on plans, details and schematics.

3.10 Blowers

.1 Install skid mounted on 100mm thickness concrete pad.

.2 Install level and secure to pad.

.3 Provide all piping and misc connections as indicated on plans, details and schematics.

.4 Provide supply air connection ducted to immediate vicinity of inlet silencers from main ventilation system as per plans.

3.11 Installation (General)

.1 Installation of clarifiers and geoforms specified under Architectural and Structural sections.

.2 Installation of Equalization and Sludge Tanks specified under Architectural and Structural sections.

.3 Provide all piping connections as indicted on plans, details and schematics to Clarifiers, Geoforms and Equalization and Sludge Tanks. Follow manufacturers and BCA recommendations for all connections.

.4 Where tank connections differ from those indicated on plans and schematics obtain direction from Engineer prior to proceeding.

END

GOULDS PUMPS

Submersible Sewage Pump

SERIES

3SD

APPLICATIONS

Used in a variety of residential, commercial and industrial applications such as:

- Sewage systems
- Flood and pollution control
- Dewatering/Effluent
- Farms
- Hospitals
- Trailer courts
- Motels

SPECIFICATIONS

Pump:

- Solids handling capabilities: 3" maximum.
- Discharge size: 3" flanged.
- Capacities: up to 365 GPM.
- Total heads: up to 45 feet TDH.
- Temperature: 104°F (40°C) continuous 140°F (60°C) intermittent.

FEATURES

■ **Impeller:** Cast iron, two vane semi-open, non-clog with pump-out vanes for mechanical seal protection. Balanced for smooth operation. Silicon bronze impeller available as an option.

■ **Casing:** Heavy duty cast iron, volute type for maximum efficiency. 3" flange conforms to 125 PSI ANSI standard. Adaptable for A10-30 slide rail system.

■ **Dual Mechanical Seals: Silicon carbide vs. silicon carbide outer seal and ceramic vs. carbon inner seal,** stainless steel metal parts, BUNA-N elastomers. Upper and lower shaft seals are positioned independently and are separated by an oil-filled chamber. Optional **TUNGSTEN CARBIDE** outer seal available.

■ **Shaft:** 300 series stainless steel keyed design.

■ **Fasteners:** 300 series stainless steel.

■ Capable of running dry without damage to components.

MOTORS

■ Fully submerged in oil-filled chamber. High grade turbine oil surrounds motor for more efficient heat dissipation, permanent lubrication of bearings and mechanical seal for complete protection against outside environment.

■ **Class F insulation.**

- **Single phase:** 1½–2 HP, 208, 230 V, 60 Hz, 1750 RPM. 14/3 STOW. Built-in overload with automatic reset.
- **Three phase:** 1½–2 HP, 200/230/460 V, 60 Hz, 1750 RPM. 14/4 STOW. Overload protection must be provided in starter unit.

■ **Designed for Continuous Operation:** Pump ratings are within the motor manufacturer's recommended working limits and can be operated continuously without damage.

■ **Bearings:** Upper and lower heavy duty ball bearing construction for precision positioning of parts and to carry thrust loads.

■ **Power Cable:** Severe duty rated, oil and water resistant. Epoxy seal on motor end provides secondary moisture barrier in case of outer jacket damage and to prevent oil wicking. 20 foot standard with optional lengths available.

■ **Seal Fail Sensor:** Located in oil-filled chamber. If water should begin to leak past lower seal, it will transmit a signal to an optional electronic sensing unit indicator service should be done on the pump, saving costly motor repairs.

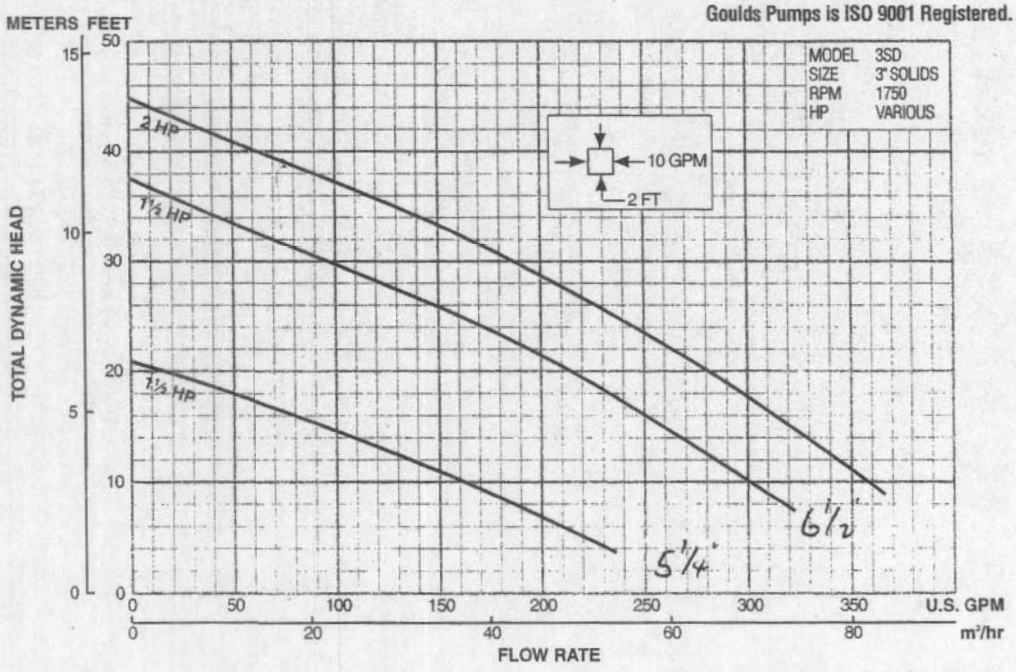
■ **O-ring:** Assures positive sealing against contaminants and oil leakage.

AGENCY LISTINGS

Canadian Standards Association File #LR38549

Underwriters Laboratories File #83318

Goulds Pumps is ISO 9001 Registered.



Goulds Pumps

ITT Industries

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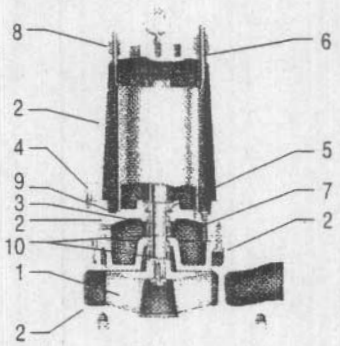
Effective September, 1999
B3SD2HP

GOULDS PUMPS

Submersible Sewage Pump

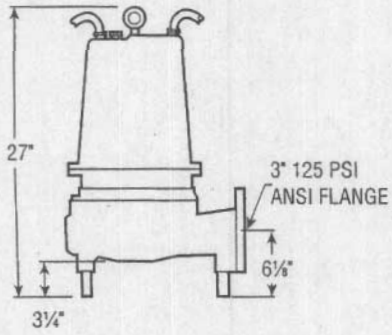
SERIES

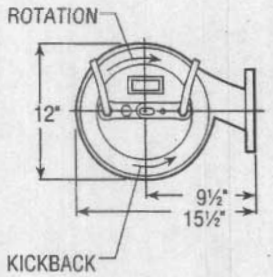
3SD



DIMENSIONS

(All dimensions are in inches. Do not use for construction purposes.)





MATERIALS OF CONSTRUCTION

Item No.	Part Name	Material: Standard	Material: Optional
1	Impeller, non-clog	1001	1101
2	Castings	1001	
3	Shaft–keyed	300 Series SS	
4	Fasteners	300 Series SS	
5	Ball bearings	Steel	
6	Power cable	STOW, 20 feet	Additional lengths
7	O-ring	BUNA-N	
8	Seal sensor cord	SJTOW	
9	Seal sensor probe	300 series ss	

Item No.	Mechanical Seals	No.	Service	Rotary	Stationary	Elastomers	Metal Parts
10	OPT	10K22	Heavy duty	Tungsten	Tungsten	BUNA-N	300 Series SS
	STD	10K28	Mild abrasives	Silicon carbide		BUNA-N	300 Series SS

Material Code	Engineering Standard
1001	Cast iron — ASTM A48 Class 20
1101	Bronze — ASTM C87500

MODELS

Series	HP	Phase	Volts*	RPM	Overload Heaters	Max. Amp.	Wt. (lbs.)
3SD52F1EA	1½	1	230	1750	NA	11.0	192
3SD52F8EA			208		NA	12.1	192
3SD52F2EA		3	200		K54	11.5	190
3SD52F3EA			230		K53	10.0	190
3SD52F4EA			460		K37	5.0	190
3SD52F1DA		1	230		NA	11.0	192
3SD52F8DA			208		NA	12.1	192
3SD52F2DA		3	200		K54	11.5	190
3SD52F3DA			230		K53	10.0	190
3SD52F4DA			460		K37	5.0	190
3SD52G1CA	2	1	230		NA	15.0	196
3SD52G8CA			208		NA	16.5	196
3SD52G2CA		3	200		K54	11.5	190
3SD52G3CA			230		K53	10.0	190
3SD52G4CA			460		K37	5.0	190

* For 575 V consult factory.

PERFORMANCE RATINGS (Gallons Per Minute)

Series No. ▶		3SD52F E	3SD52F D	3SD52G C
HP ▶		1½	1½	2
Imp. Dia. ▶		5¼"	6½"	7"
RPM ▶		1750		
Total Head Feet of Water	10	161	300	360
	15	99	260	320
	20	12	210	280
	25		160	240
	30		100	185
	35		35	130
	40			60

Goulds Pumps

ITT Industries

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

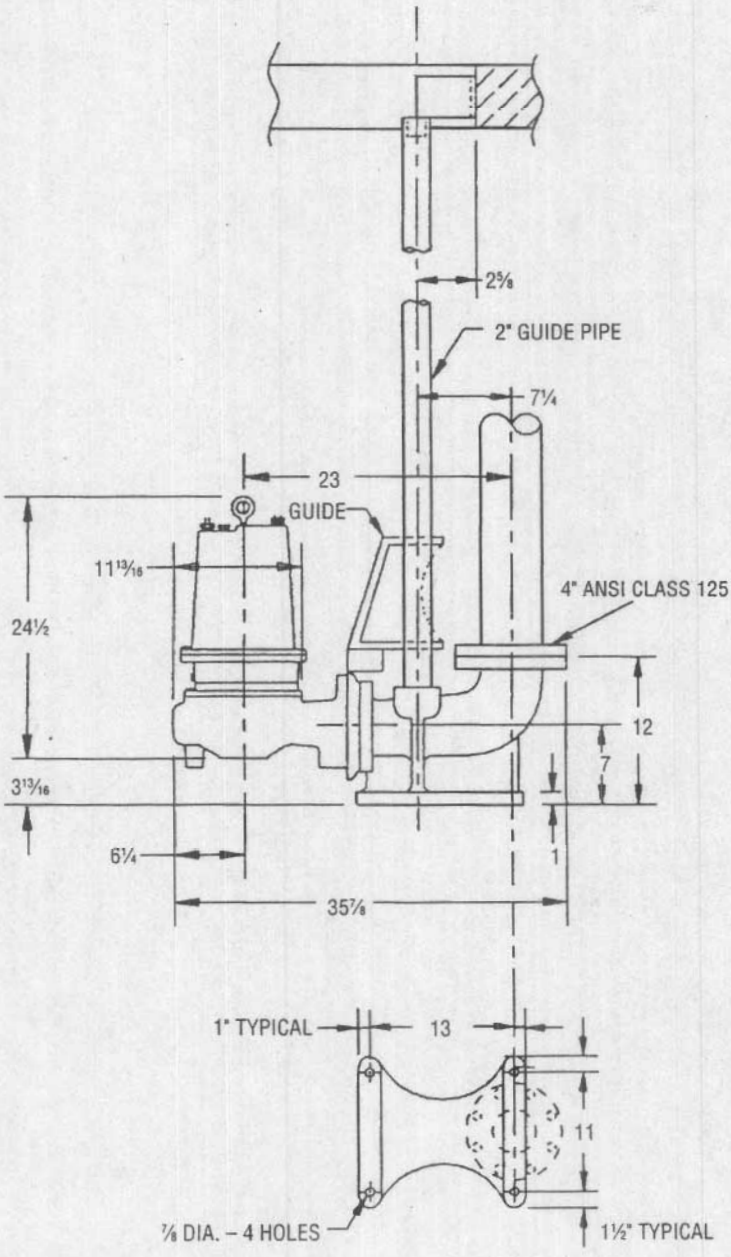
GOULDS PUMPS

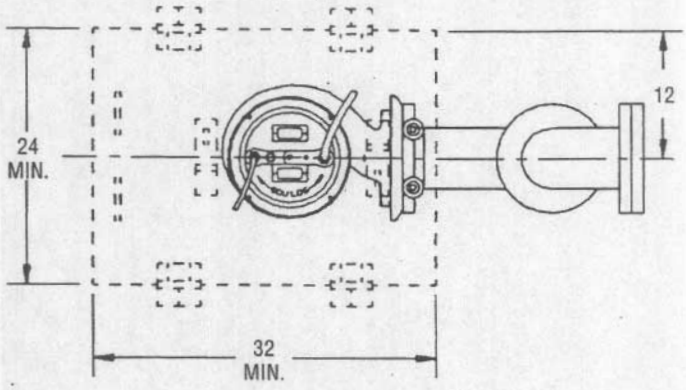
Installation Dimension Layout

SERIES

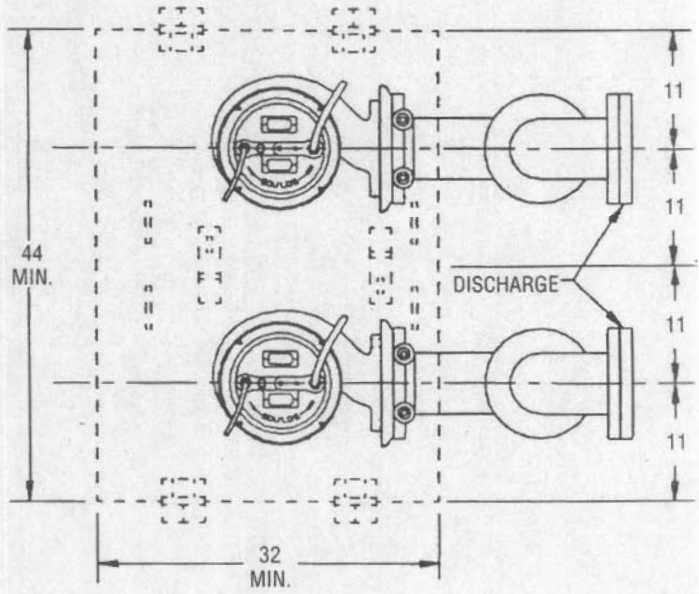
3SD

3 x4 Slide Rail





SIMPLEX



DUPLEX

(All dimensions are in inches. Do not use for construction purposes.)

Goulds Pumps

ITT Industries

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Effective February, 2000
3SDIDL

IPEC INDUSTRIES

Robert
Ann

Proposal No. 2011144

To: Rich Johnson
BCA
#200 – 14666 64th Avenue
Surrey, BC V3S 1X7
Email: rjohnson@clearwaterworld.com

Fax: 604-501-6172
Voice: 604-501-6171

Project: Intake Screening
Date: November 23rd, 2001

WE ARE PLEASED TO QUOTE AS FOLLOWS:

One (1) only **IPEC Model IFU 3036 Medium Duty Internally Fed Uni-frame Rotary Screen**, complete with:

- uni-frame screen housing, fabricated in 304 stainless steel, supports trunnions, drive and headbox;
- 30" diameter by 36" long, wedgewire screen drum with slot openings of 3mm;
- internal headbox, extending 2/3 the length of the drum, in 10 gauge, 304 stainless steel;
- integral splash guards, drainage pan and solids chute in 11 gauge, 304 stainless steel;
- enclosure panels in 304 stainless steel;
- connections are 304 stainless steel stub ends c/w galvanized back up flanges;
- external spray bar c/w 11 fan jet, spray nozzles and hinged splash cover;
- polymeric driven sprocket and stainless steel drive chain;
- shaft mounted, 6" diameter by 2" wide, UHMW polyurethane, roll wheels, with internal bearings;
- ½ hp, TEFC, motor and gearbox;
- 30" mounting stand in 304 stainless steel;
- 2 copies of the Installation, Operation and Maintenance Manual.

WE ARE PLEASED TO QUOTE AS FOLLOWS:

One (1) only **Screenings Conveyor/Compactor**, all 316 stainless steel construction, as follows:

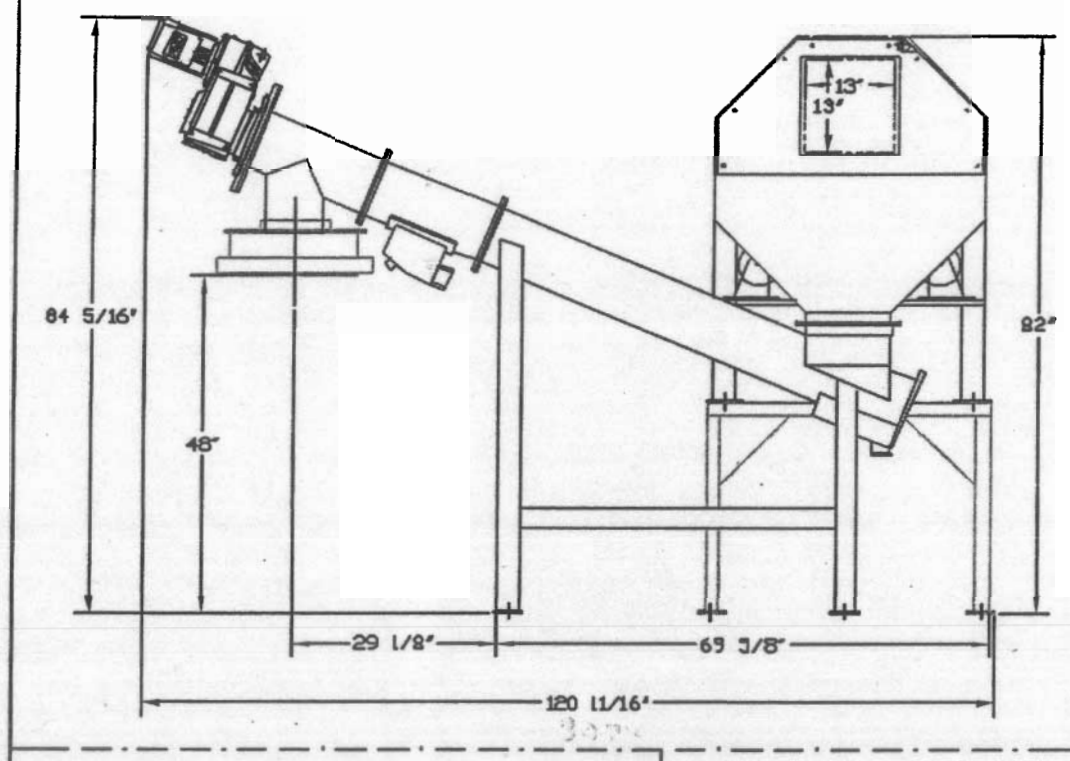
Press Screw:	7 ½" diameter by 99" long, variable pitch, on 3" Sch.40 pipe shaft, 2" drive shaft.
Screen Element:	Wedgewire, 93 wire @ 0.5 mm slot, 18" compaction zone.
Enclosure:	10 gauge construction, 12" by 18" open inlet, 8" diam. outlet, 3" FNPT drain for presage.
Mechanical:	1 hp, TEFC, helical, flange mounted, geardrive.

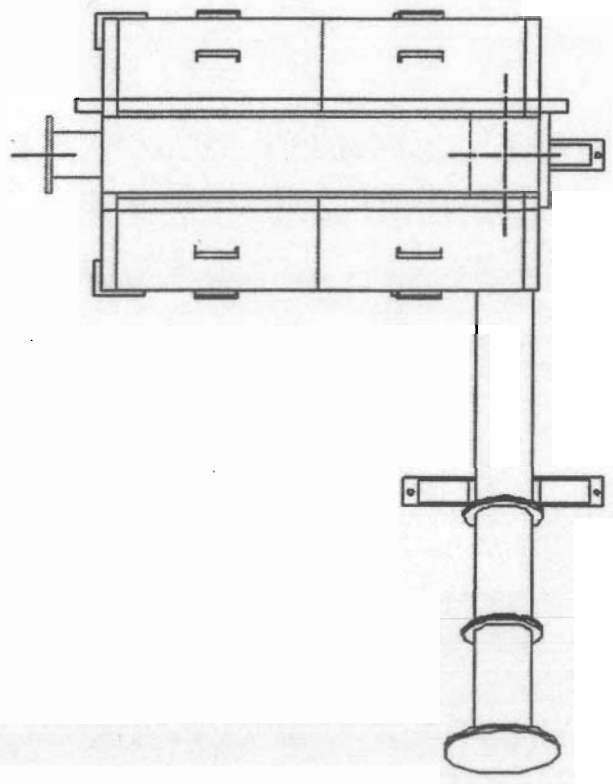
WE ARE PLEASED TO QUOTE AS FOLLOWS:

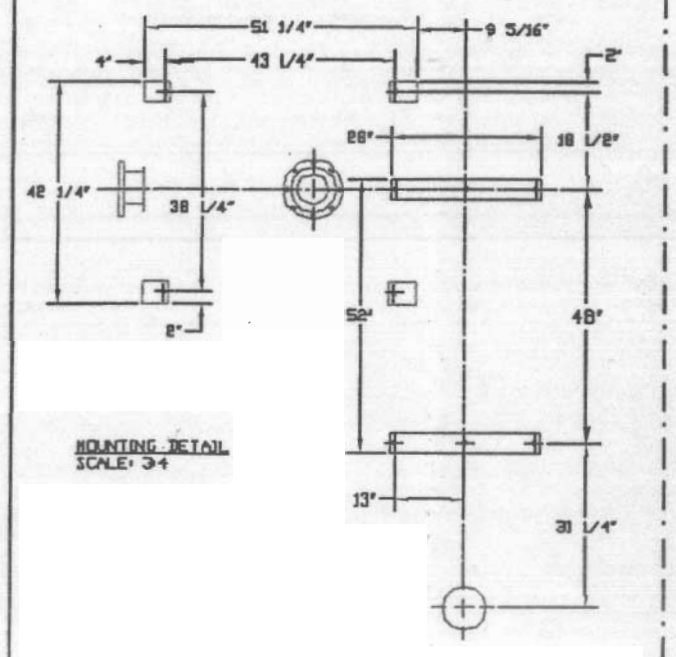
One (1) only **Screenings Bagging Device**, as follows:

- screenings bagging device shall be mounted to the discharge chute to collect and contain screening debris. The bagging device shall be fitted with a replaceable magazine of continuous, clear plastic.
- dimensions are 22" x "22" x 8"
- accessories: replaceable bag

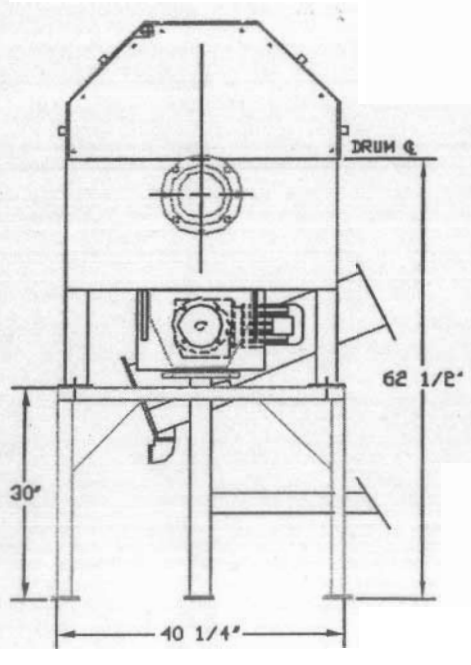
Service: To handle 200 gpm municipal effluent (Max Capacity 500 gpm)

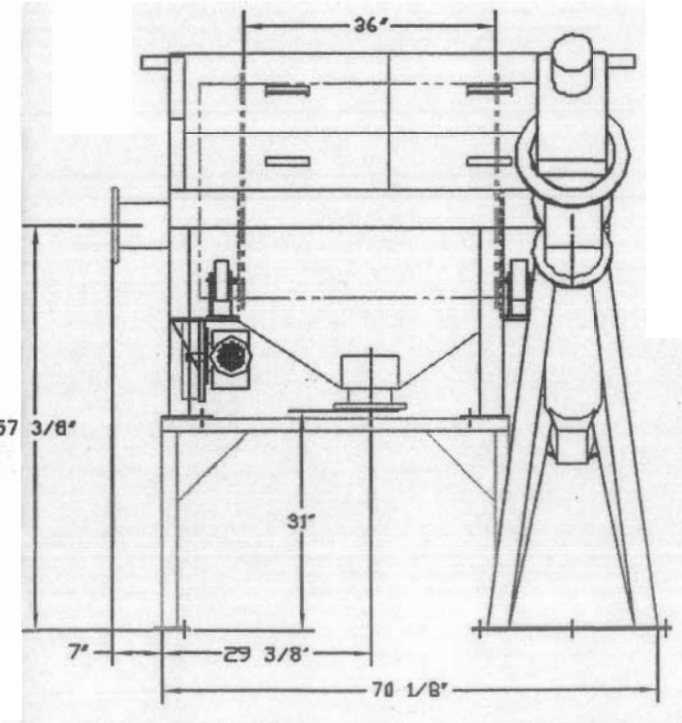






MOUNTING DETAIL
SCALE: 3/4





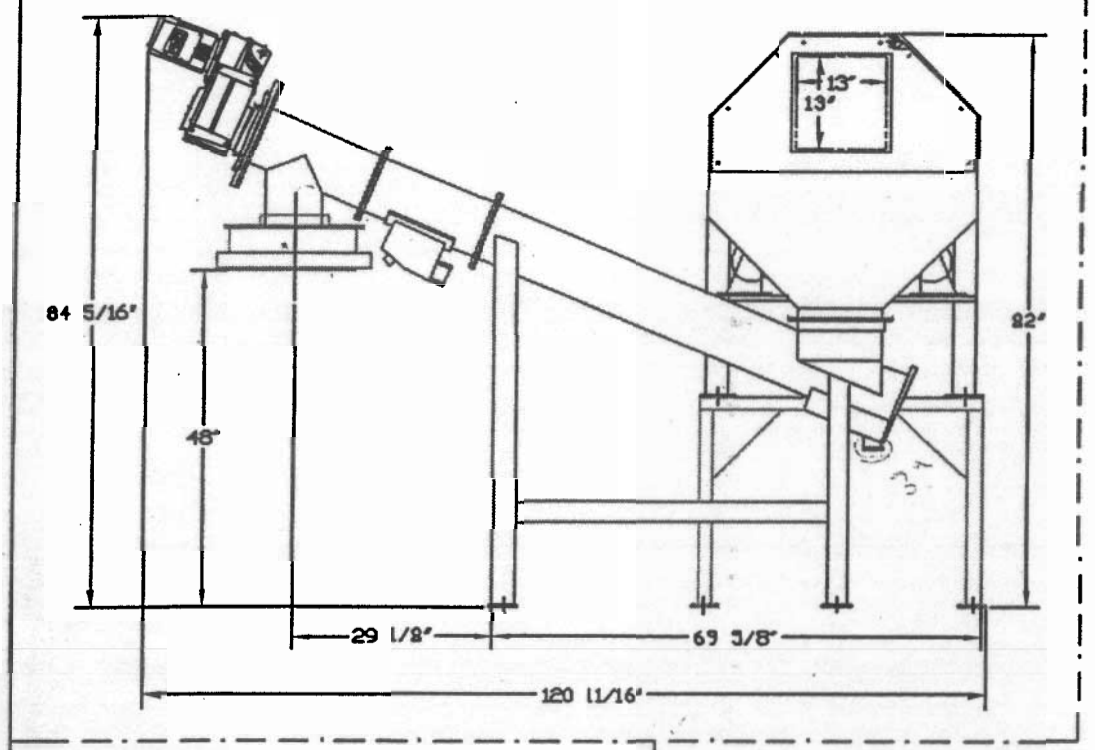
IFU3036

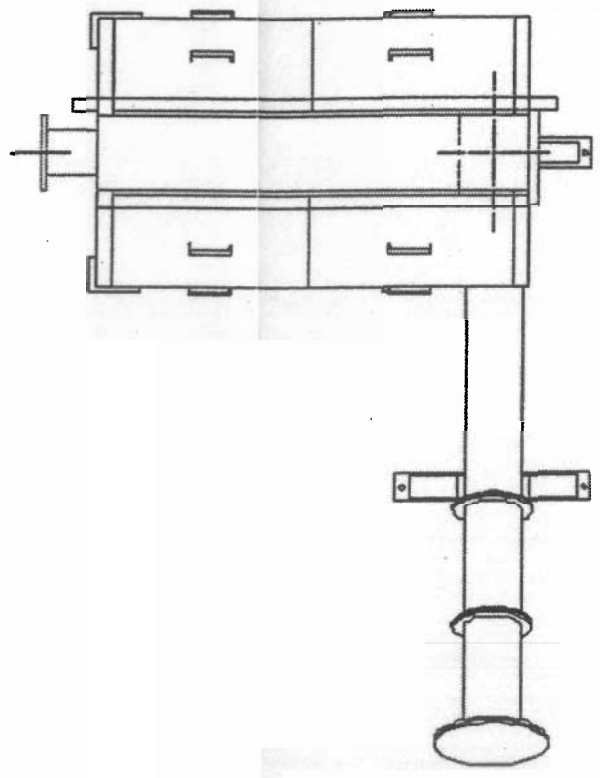
1	23**	SCREEN DRUM DIM: 30" X 48" CONST: **** MATERIAL: 304 SS SLOT: **** FITTINGS: 23021 & 23022 ROLL CYLINDER
2	13300	ENCLOSURE CONST: 3" X 3" X 1/8" TUBE / 18 GA MATERIAL: 304 SS FITTINGS: FILTRATE: 8" SCH PIPE C/W ANSI FLANGE SOLIDS: 10" X 12" FLANGED
3	13305	COVERS TOP: (1): 11 GA. TOP/SIDES (4): 14 GA. ENDS (2): 14 GA. MATERIAL: 304 SS
4	43300	HEAD BOX CONST: 10 GA. SCH.10 PIPE MATERIAL: 304 SS FITTINGS: 6" SCH PIPE C/W ANSI FLANGE
5		DRIVE SYSTEM MFG.: EURODRIVE MODEL: SF37DT7104 ACCESSORIES: INTEGRAL MOTOR: 1/2 hp ***/3/60 TEFC SPROCKETS: 60A***, 60SA** CHAIN #60 304 S.S.
6	31052-30 8	SPRAY BAR 1 1/4" SCH 40 PIPE WITH 16 FAN JET NOZZLES @ 3" C/C 1 GPM @ 40 PSI
		PSC 8100
6	***	SPIRAL ASSEMBLY DIM: 47 1/2" X 99" CONST: 1/2" FLIGHTS ACCESSORIES: SPIRAL BRUSH MATERIAL: 304 SS DRIVE SHAFT: 83" X 4.5" .304 SS
8	***	TRANSPORT TUBE DIM: 8 ID X 44 5/8" CONST: 8" SCH 10 PIPE MATERIAL: 304 SS FITTING: 3 - 3/16" WEAR STRIPS 2" FNPT DRAIN
7	***	PRESS ZONE DIM: 6" ID X 18" CONST: 6" SCH 10 PIPE MATERIAL: 304 SS FITTING: 6" ID WEDGE WIRE .020" SLOT 2" FNPT DISCHARGE
8	***	DISCHARGE SECTION DIM: 8" ID X 18" CONST: 8" SCH 10 PIPE MATERIAL: 304 SS FITTING: 8" DISCHARGE
9	***	SPRAY WASH PRESS ZONE WASH CONST: 1/2" SCH 40 1 NOZZLE 6 GPM @ 40 PSI
10		DRIVE SYSTEM MFG.: EURODRIVE MODEL: FAF77DT80N4 MOTOR: ***** 1hp ***/3/60 TEFC 1750 rpm
		SCREENINGS BAGGER
11	***	BAGGING ASSEMBLY DIM: 32" X 22" X 8" ACCESSORIES: REPLACEABLE BAG

SYM.	DESCRIPTION	DATE	BY

REVISIONS

CUSTOMER: BCA	TITLE: IFU 3038 C/W SCREENINGS COMPACTOR & BAGGER	IPEC IPEC CONSULTANTS 2986 NORLAND AVE BURNABY B.C. CANADA V5B 3A8 1 800 663 6408
QUOTE NO: 2011143	REVISION: ***	SCALE: ***
DRAWN AMO.	CHKD AMO.	DWG. NO: U3038201 REV: 0
DATE: NOV. 28, 2001	DATE: NOV. 28, 2001	

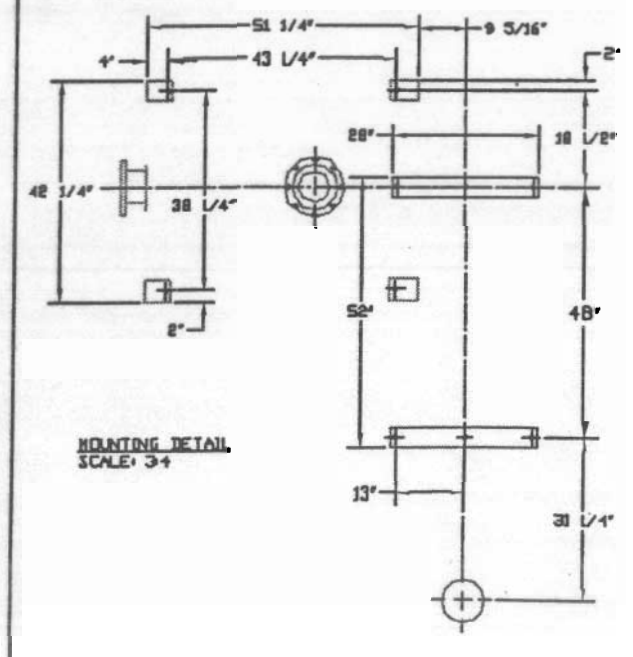




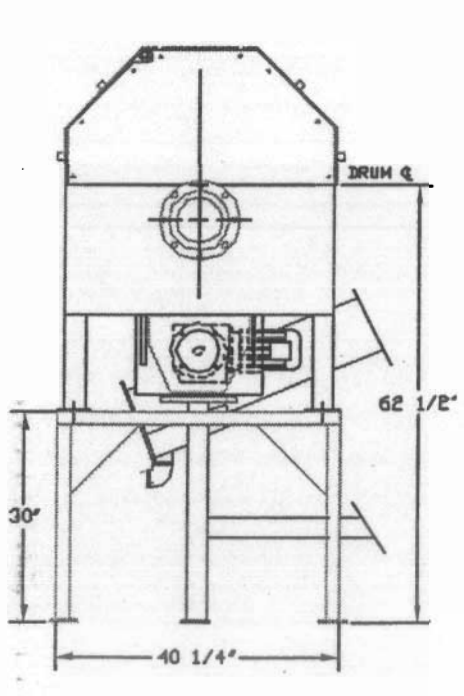
	IFU3036	
1	23**	SCREEN DRUM DIM: 30" X 48" CONST: **** MATERIAL: 304 SS SLOT: **** FITTINGS: 23021 & 23022 ROLL CYLINDER
2	13300	ENCLOSURE CONST: 3" X 3" X 1/8" TUBE / 18 GA MATERIAL: 304 SS FITTINGS: FILTRATE: 8" SCH PIPE C/W ANSI FLANGE SOLIDS: 10" X 12" FLANGED
3	13305	COVERS TOP (1): 11 GA. TOP/SIDES (4): 14 GA. ENDS (2): 14 GA. MATERIAL: 304 SS
4	43300	HEAD BOX CONST: 10 GA. SCH.10 PIPE MATERIAL: 304 SS FITTINGS: 6" SCH PIPE C/W ANSI FLANGE
5		DRIVE SYSTEM MFG.: EURODRIVE MODEL: SF37DT71D4 ACCESSORIES: INTEGRAL MOTOR: 1/2 hp ***/3/60 TEFC SPROCKETS: 60A**, 60SA** CHAIN: #60 304 S.S.
6	9100830 8	SPRAY BAR 1 1/4" SCH 40 PIPE WITH 16 FAN JET NOZZLES @ 3" C/C 1 GPM @ 40 PSI
		PSC 8100
6	***	SPIRAL ASSEMBLY DIM: 47 1/2" X 98" CONST: 1/2" FLIGHTS ACCESSORIES: SPIRAL BRUSH MATERIAL: 304 SS DRIVE SHAFT: 83" X 48" 304 SS
8	***	TRANSPORT TUBE DIM: 6 ID X 44 5/8" CONST: 6" SCH 10 PIPE MATERIAL: 304 SS FITTING: 3 - 3/16" WEAR STRIPS 2" FNPT DRAIN
7	***	PRESS ZONE DIM: 6" ID X 18" CONST: 6" SCH 10 PIPE MATERIAL: 304 SS FITTING: 6" ID WEDGE WIRE .020" SLOT 2" FNPT DISCHARGE
8	***	DISCHARGE SECTION DIM: 8" ID X 18" CONST: 6" SCH 10 PIPE MATERIAL: 304 SS FITTING: 90° DISCHARGE
9	***	SPRAY WASH PIECES ZONE WASH CONST: 1/2" SCH 40 1 NOZZLE 6 GPM @ 40 PSI
10		DRIVE SYSTEM MFG.: EURODRIVE MODEL: FAF77DT80N4 MOTOR: ***** 1hp ***/3/60 TEFC 1750 rpm
		SCREENINGS BAGGER
11	***	BAGGING ASSEMBLY DIM: 32" X 22" X 8" ACCESSORIES: REPLACEABLE BAG

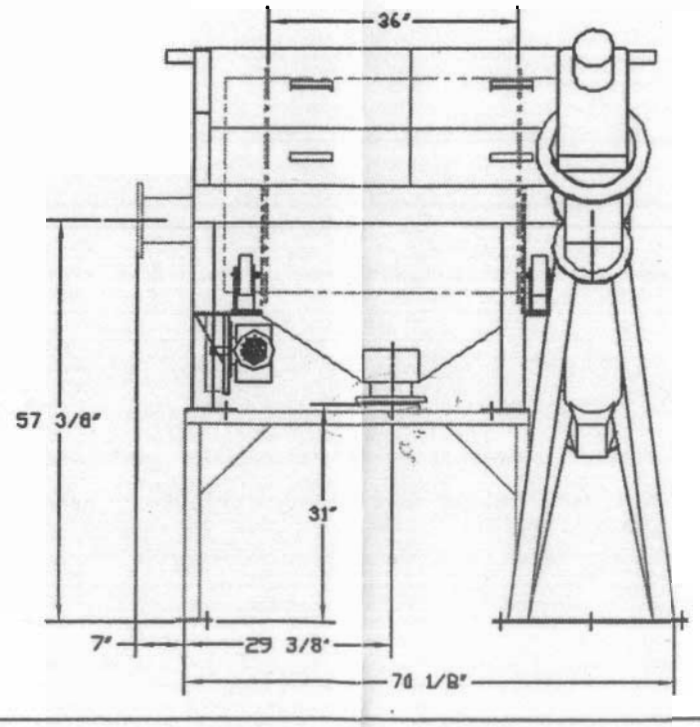
SYM.	DESCRIPTION	DATE	BY
	REVISIONS		

CUSTOMER: BCA	TITLE: IFU 3038 C/W SCREENINGS COMPACTOR & BAGGER	IPEC IPEC CONSULTANTS 2889 NORLAND AVE BURNABY B.C. CANADA V5B 3A8 1 800 663 4408
QUOTE NO: 2011143	DRAWN: ***	SCALE: ***
CHKD: AAA	DATE: AAA	DWG. NO: U303820 REV: 0
DATE: NOV. 28, 2001	DATE: NOV. 28, 2001	



MOUNTING DETAIL
SCALE: 3/4

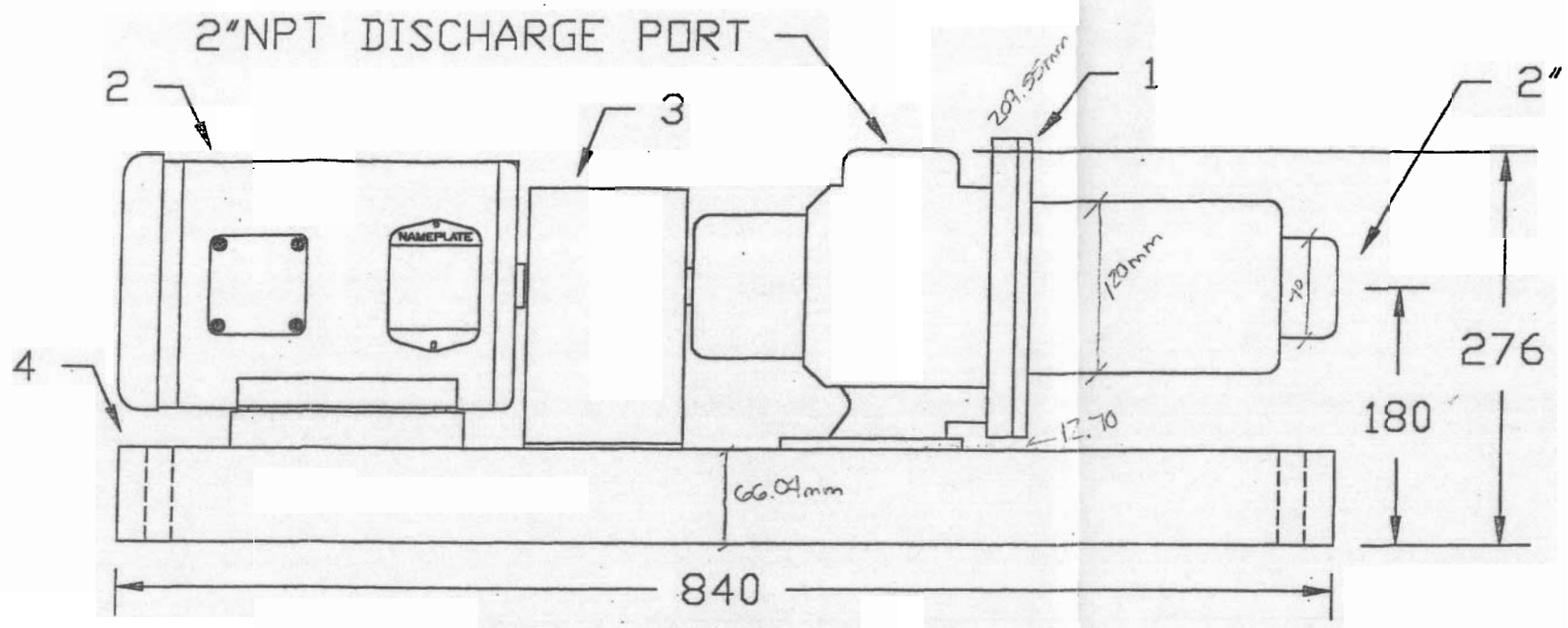




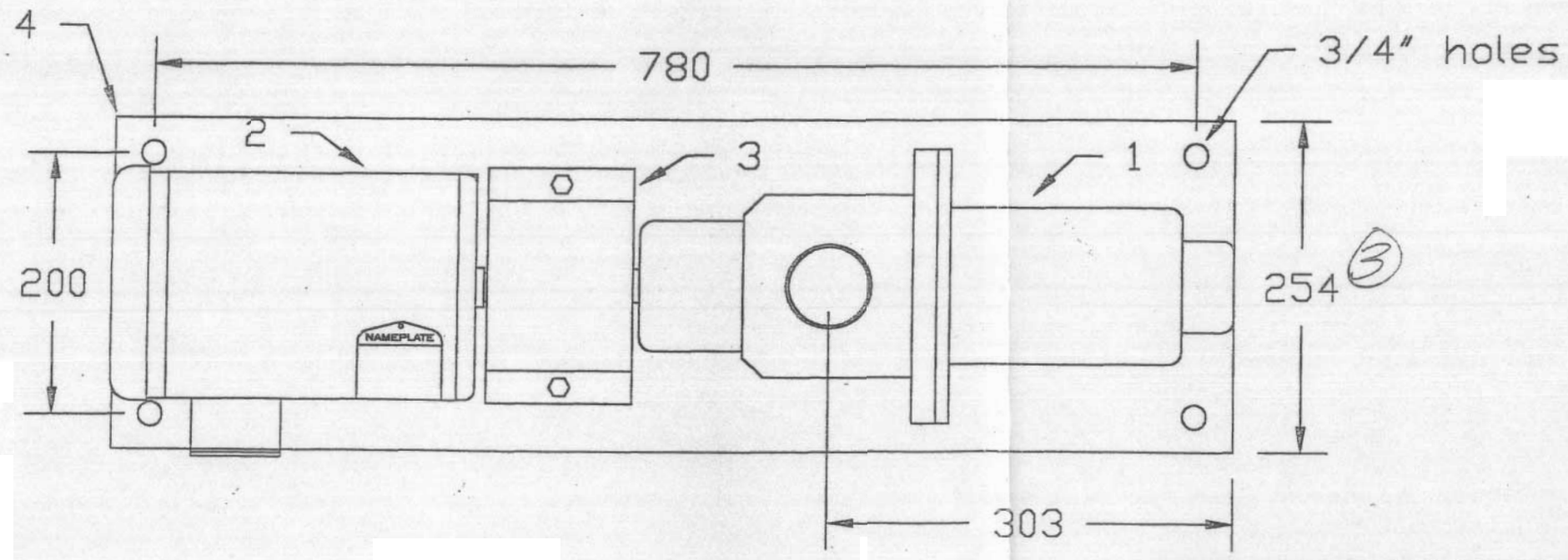
575/3φ/60

SC-1

MATERIAL LIST		
ITEM	QUAN.	DESCRIPTION
1	1	EAGLE EP-67-CSQM PROGRESSING CAVITY PUMP
2	1	1 HP, 1150 RPM, 575-3-60, TEFC, ELECTRIC MOTOR, FRAME 145T
3	1	FLEXIBLE COUPLING COMPLETE WITH COUPLING GUARD
4	1	FABRICATED STEEL BASE



MAIN FEED PUMPS



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REV.	DCN No.	DATE	BY

APPROVED DATE

METRIC DRAWING
ALL DIMENSIONS IN MILLIMETERS

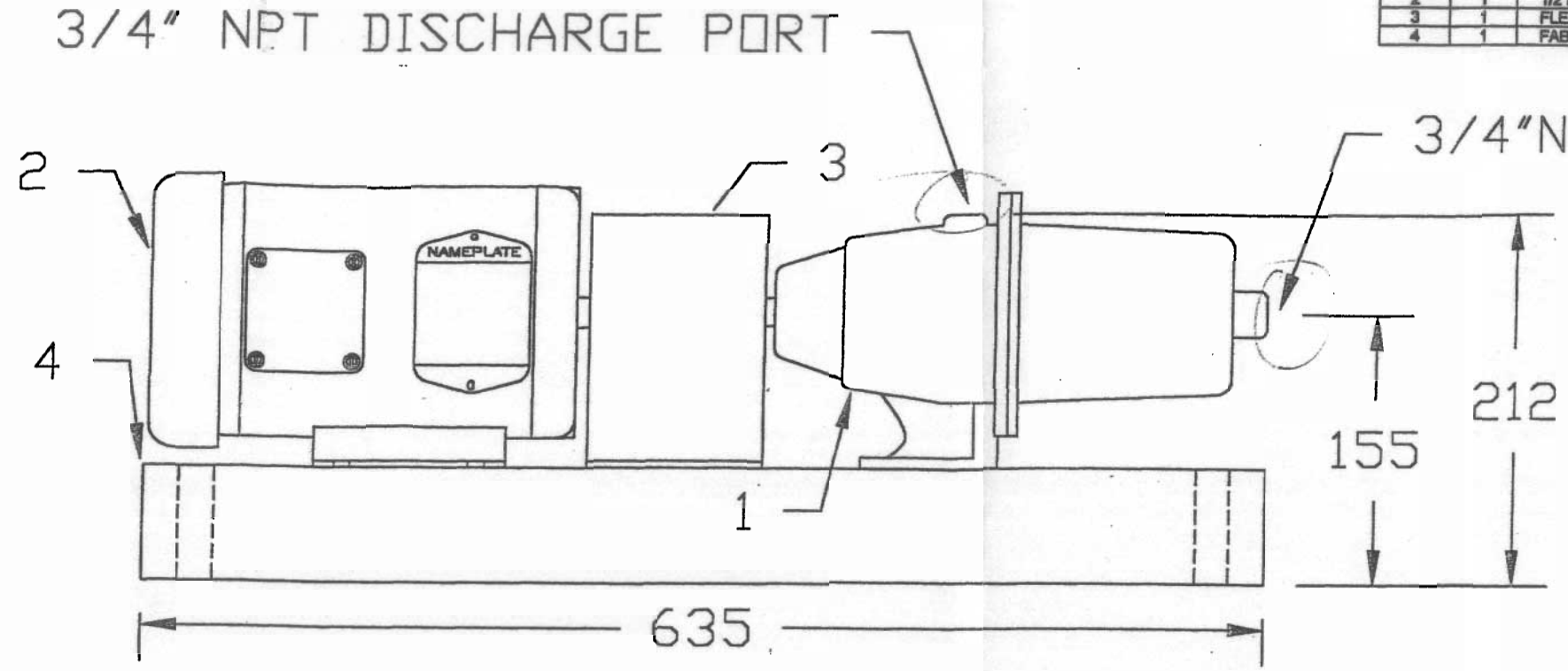
DESIGNED:	DQ	DATE 28/12/01
DRAWN:	DQ	DATE 28/12/01
CHECKED:	DH	DATE 28/12/01
APPROVED:	DQ	DATE 28/12/01

SPECIALTY EQUIPMENT LTD.

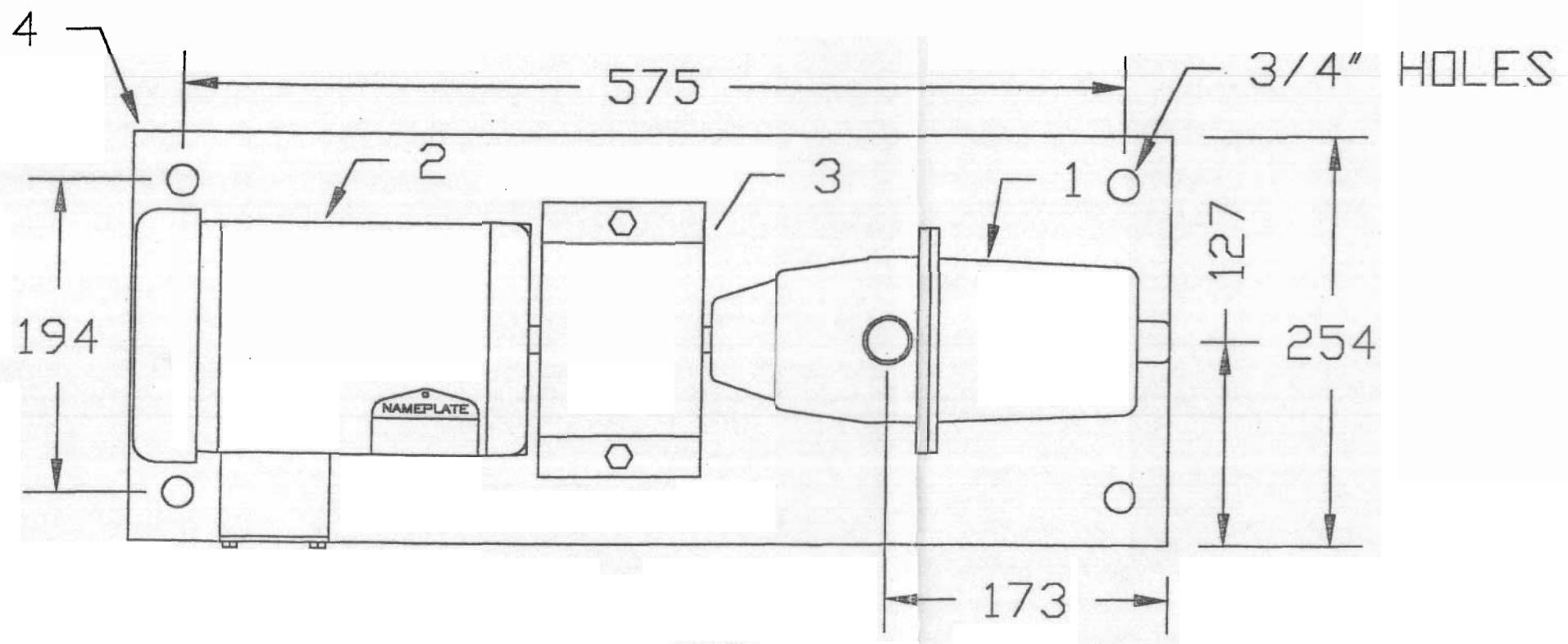
TITLE: BCA INDUSTRIAL CONTROLS
EAGLE EP-67 / 1 HP

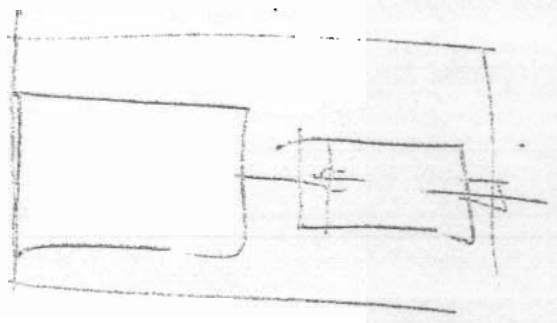
SCALE	TYPE	SIZE	SHEET	DWG. No.	REV.
NTS	D	D	1 OF 1	47489-1	0

MATERIAL LIST		
ITEM	QUAN.	DESCRIPTION
1	1	EAGLE MODEL EP-44-CSQM PROGERSSING CAVITY PUMP
2	1	1/2 HP, 1150 RPM, 573-3-60, TEFC, ELECTRIC MOTOR, FRAME 56
3	1	FLEXIBLE COUPLING WITH COUPLING GUARD
4	1	FABRICATED STEEL BASE



SLUDGE PUMPS





(A)

REV.	DCN No.	DATE	BY

APPROVED _____ DATE _____

METRIC DRAWING
ALL DIMENSIONS IN MILLIMETERS

DESIGNED:	DQ	DATE 28/12/01
DRAWN:	DQ	DATE 28/12/01
CHECKED:	DH	DATE 28/12/01
APPROVED:	DQ	DATE 28/12/01

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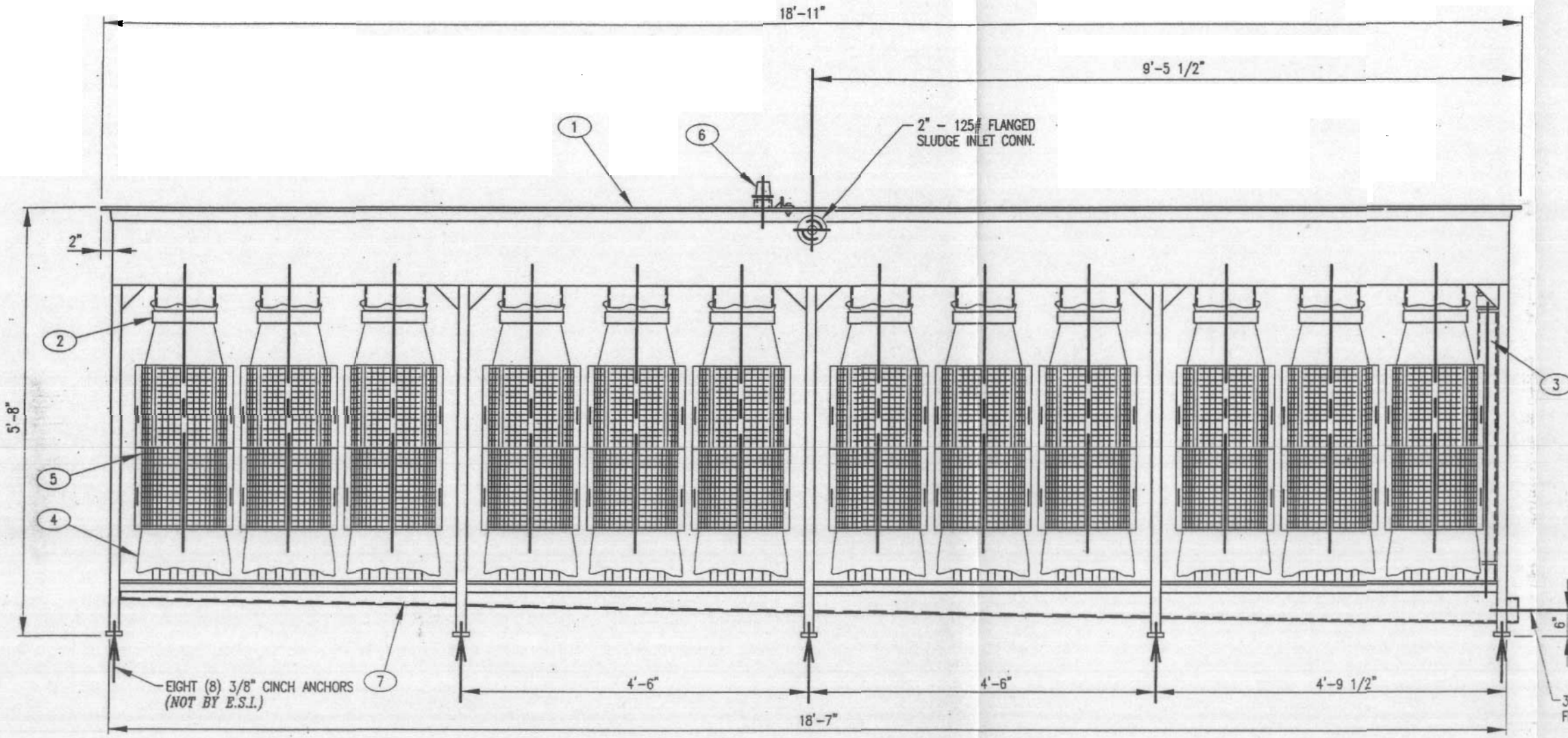
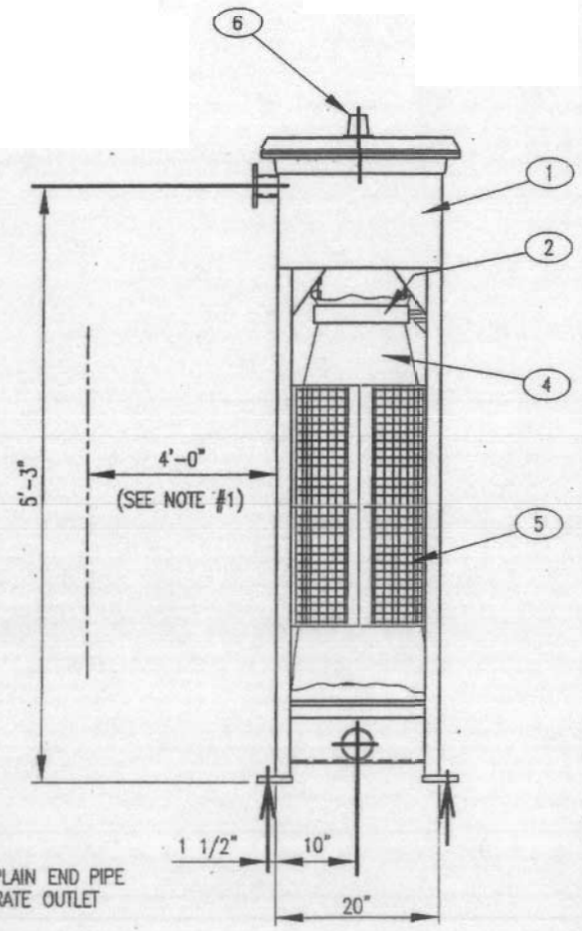
SPECIALTY EQUIPMENT LTD.

TITLE: BCA INDUSTRIAL CONTROLS
EAGLE EP-44 / 1/2 HP

SCALE	TYPE	SIZE	SHEET	DWG. No.	REV.
NTS	D	D	1 OF 1	47489-2	0

ITEM	DESCRIPTION
1	DISTRIBUTION HOOD
2	QUICK-OPENING BAG HOLDER
3	OVERFLOW PIPE
4	DEWATERING BAG
5	QUICK – OPENING SUPPORT CAGE
6	LEVEL PROBE ASSEMBLY
7	FILTRATE PAN





NOTES:

1. SUGGESTED MINIMUM CLEARANCE FOR BAG REMOVAL.

PANGNIRTUNG, NUNAVUT, CANADA
VILLAGE OF PANGNIRTUNG

ENVIRODYNE SYSTEMS INC.
Camp Hill, Pennsylvania 17011

TITLE: GENERAL ARRANGEMENT
ALL-AMERICAN™ BAGGER
MODEL SBS-12i (INLINE)

E.S.I. NOT RESPONSIBLE FOR CONCRETE DESIGN. CONCRETE SHOWN FOR IDENTIFYING PURPOSES ONLY.

SHOP ORDER NO. 6694(A)

SCALE:	DWN. BY:	DATE	DRAWING NO.
NTS	MD	01/04/02	512-B-40025

REVISION | DATE

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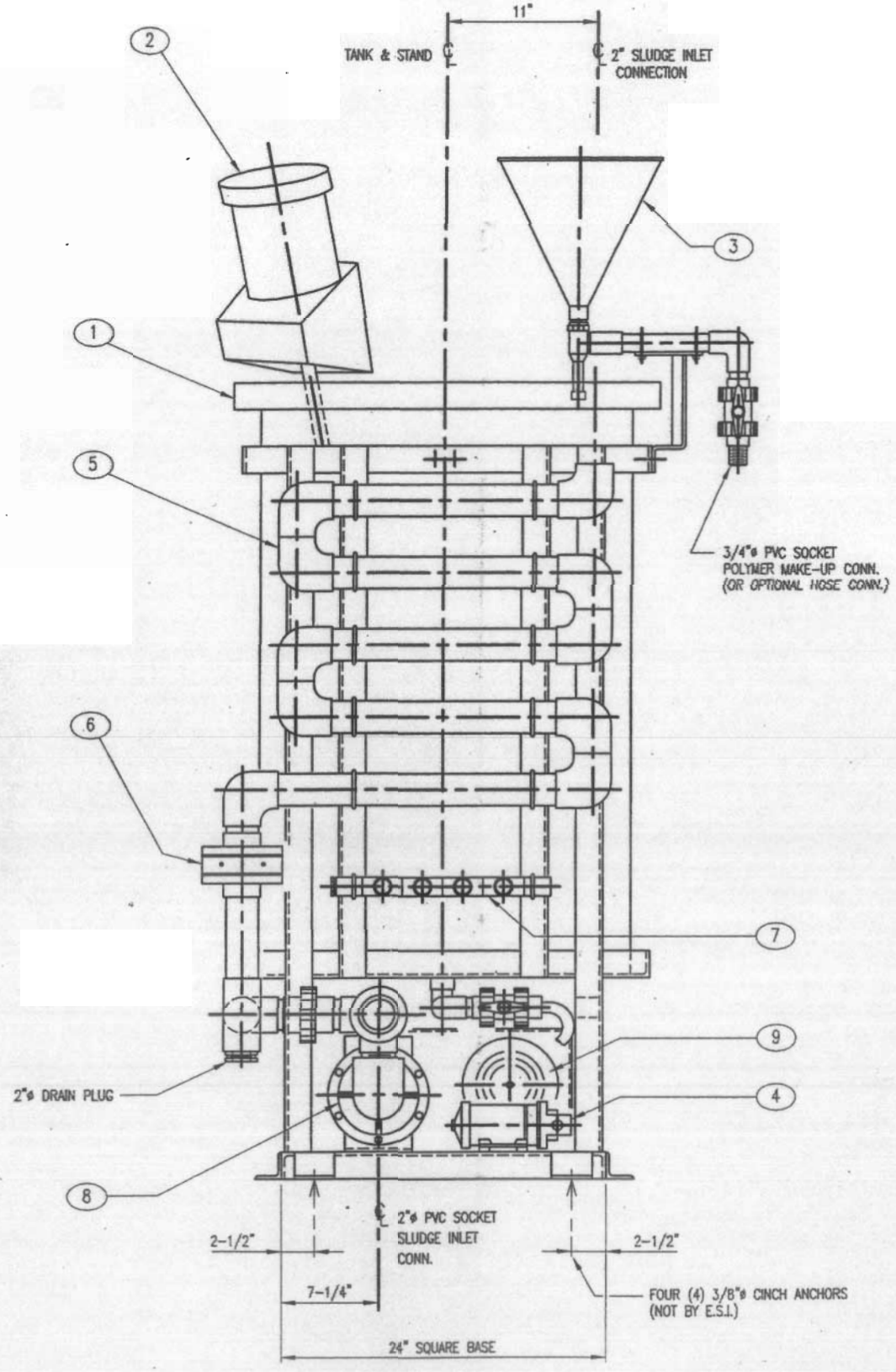

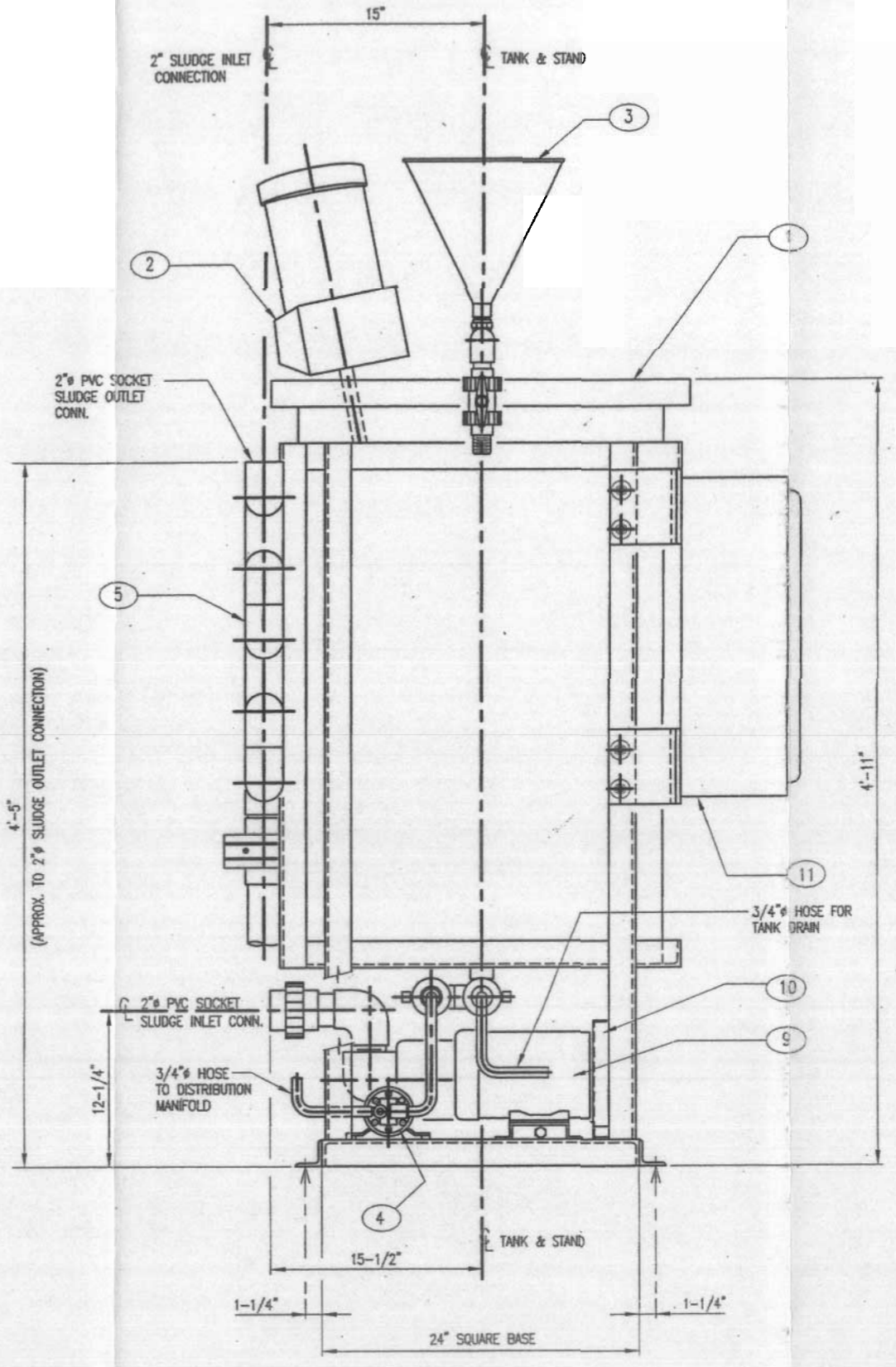

REF.	DESCRIPTION
1	POLYMER MIXING TANK
2	POLYMER MIXER
3	EDUCTOR & FUNNEL ASSEMBLY
4	POLYMER FEED PUMP
5	STATIC MIXER ASSEMBLY
6	POLYMER INJECTION RING
7	DISTRIBUTION MANIFOLD
8	SLUDGE FEED PUMP
9	SLUDGE FEED PUMP MOTOR
10	BELT GUARD
11	SYSTEM CONTROL PANEL

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REVISION | DATE

PANGNIRTUNG, NUNAVUT, CANADA
VILLAGE OF PANGNIRTUNG

ENVIRODYNE SYSTEMS INC.
Camp Hill, Pennsylvania 17011

TITLE
GENERAL ARRANGEMENT
POLYMER FEED SUB-SYSTEM
(MODEL PFS-100)

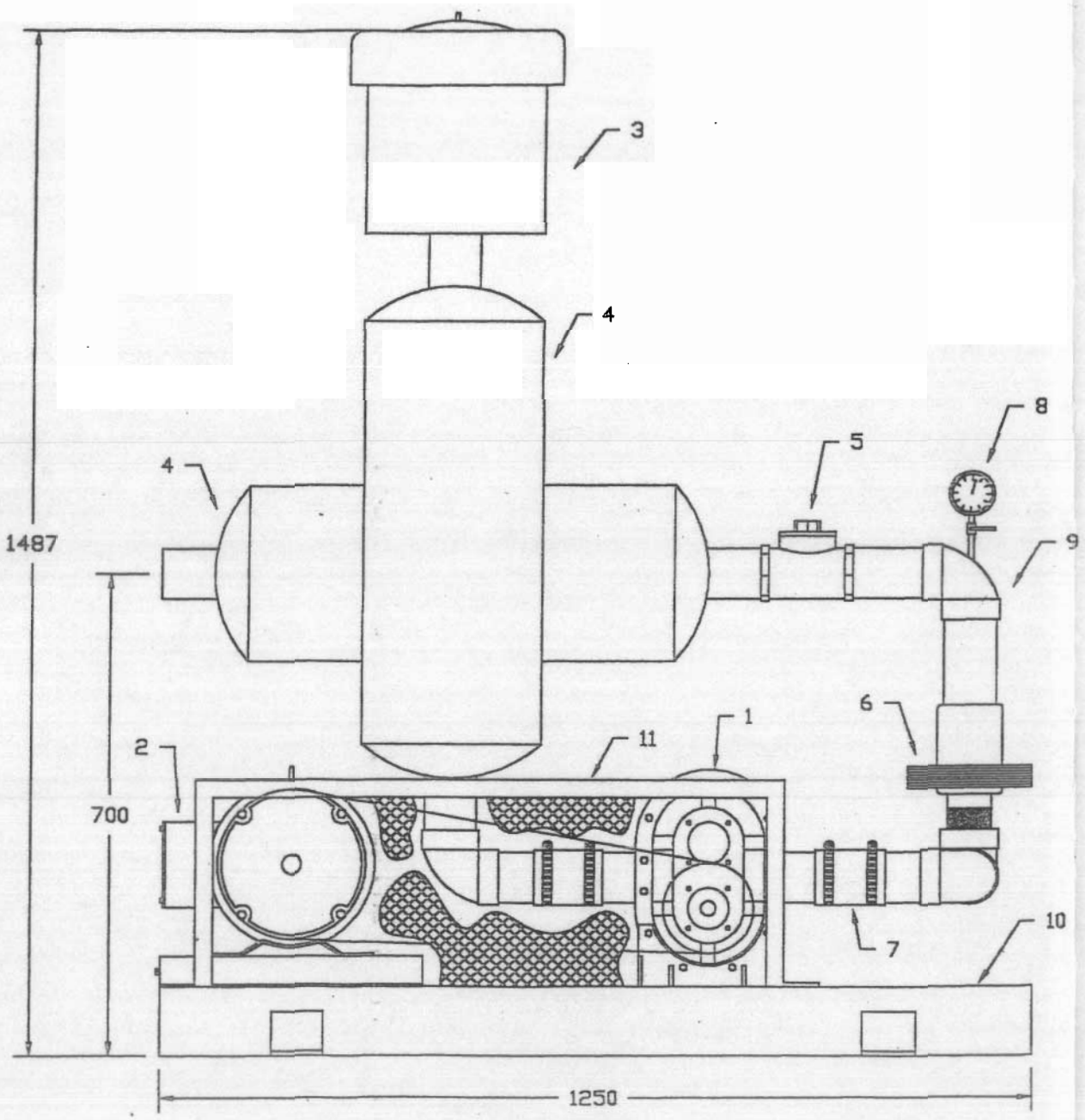
E.S.I. NOT RESPONSIBLE FOR CONCRETE DESIGN. CONCRETE SHOWN FOR IDENTIFYING PURPOSES ONLY.

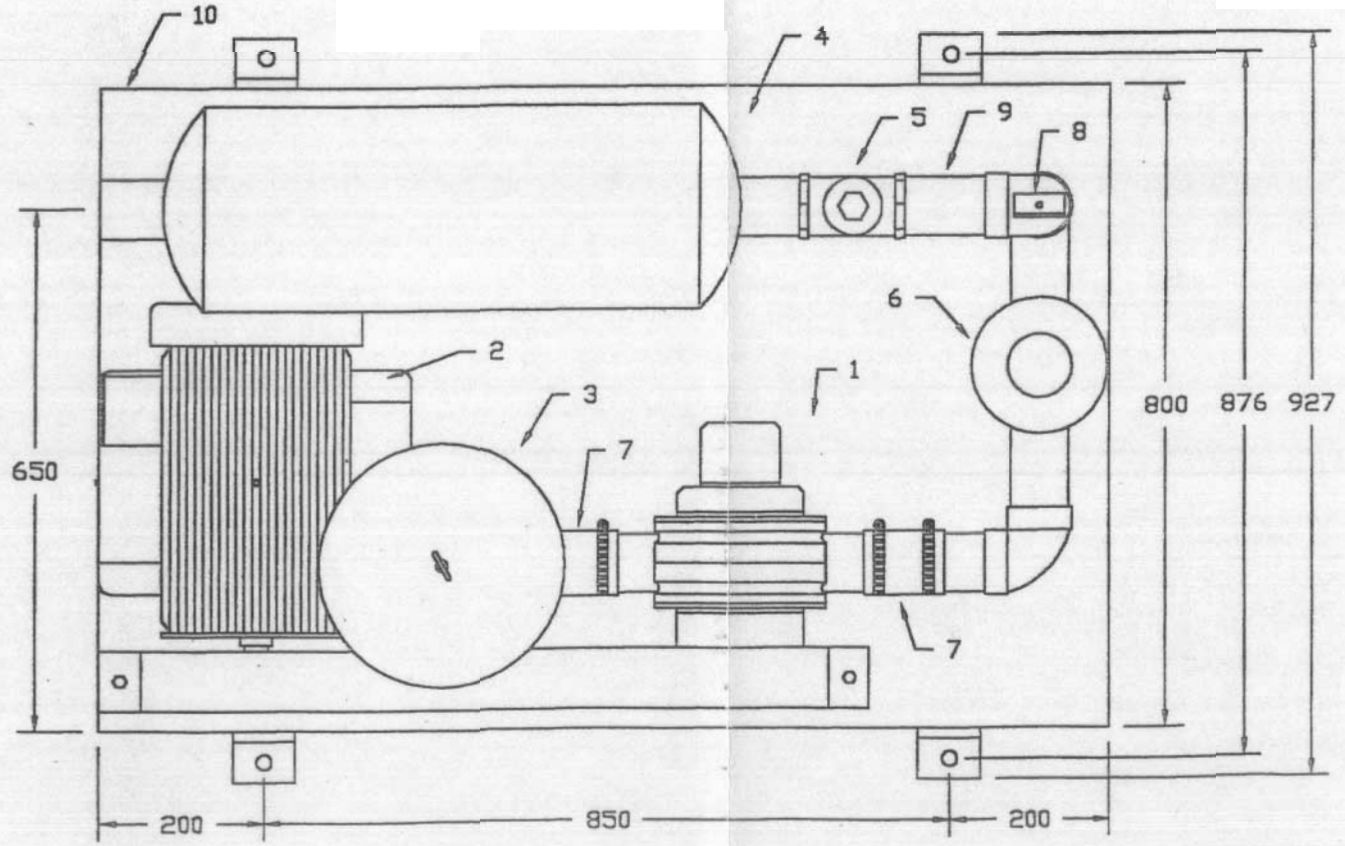
SHOP ORDER NO. 6594(B)

SCALE:	DWN. BY:	DATE	DRAWING NO.
—	MD	01/07/02	600-B-40026

MATERIAL LIST		
ITEM	QUAN.	DESCRIPTION
1	1	SUTORBILT 4HV-P BLOWER IN STANDARD CONSTRUCTION
2	1	7.5 HP, 1750 RPM, 575-3-60, TEFC ELECTRIC MOTOR FRAME # 213T WITH ADJUSTABLE BASE
3	1	UNIVERSAL CCS 2.5 INLET FILTER / SILENCER
4	2	UNIVERSAL SILENCER MODEL URB 2.5
5	1	FORTUNE 2 1/2" BRONZE CHECK VALVE MODEL 170T
6	1	SUTORBILT 2" WEIGHT LOADED RELIEF VALVE SET AT 7.5 PSI
7	2	ROLLEE 2 1/2" FLEX CONNECTOR MODEL SW68-33
8	1	2 1/2" LIQUID FILLED PRESSURE GAUGE COMPLETE WITH ISOLATING VALVE
9	1	STEEL PIPE ASSEMBLE WITH THREADED FITTINGS
10	1	FABRICATED STEEL BASE WITH ANGLE IRON FEET
11	1	V BELT DRIVE WITH ENCLOSED BELT GUARD

Eaton Manual





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REV.	DCN No.	DATE	BY
APPROVED		DATE	

METRIC DRAWING
ALL DIMENSIONS IN MILLIMETERS

DESIGNED:	DQ	DATE 27/12/01
DRAWN:	DQ	DATE 27/12/01
CHECKED:	DH	DATE 27/12/01
APPROVED:	DQ	DATE 27/12/01

SPECIALTY EQUIPMENT LTD.

TITLE: BCA INDUSTRIAL CONTROLS

SUTORBILT 4HV-P / 7.5 HP

SCALE	TYPE	SIZE	SHEET	DWG. No.	REV.
NTS	D	A	1 OF 1	47486	0

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REV.	DCN No.	DATE	BY

APPROVED

DATE

DESIGNED: DQ	DATE 27/12/01
DRAWN: DQ	DATE 27/12/01
CHECKED: DH	DATE 27/12/01
APPROVED: DQ	DATE 27/12/01

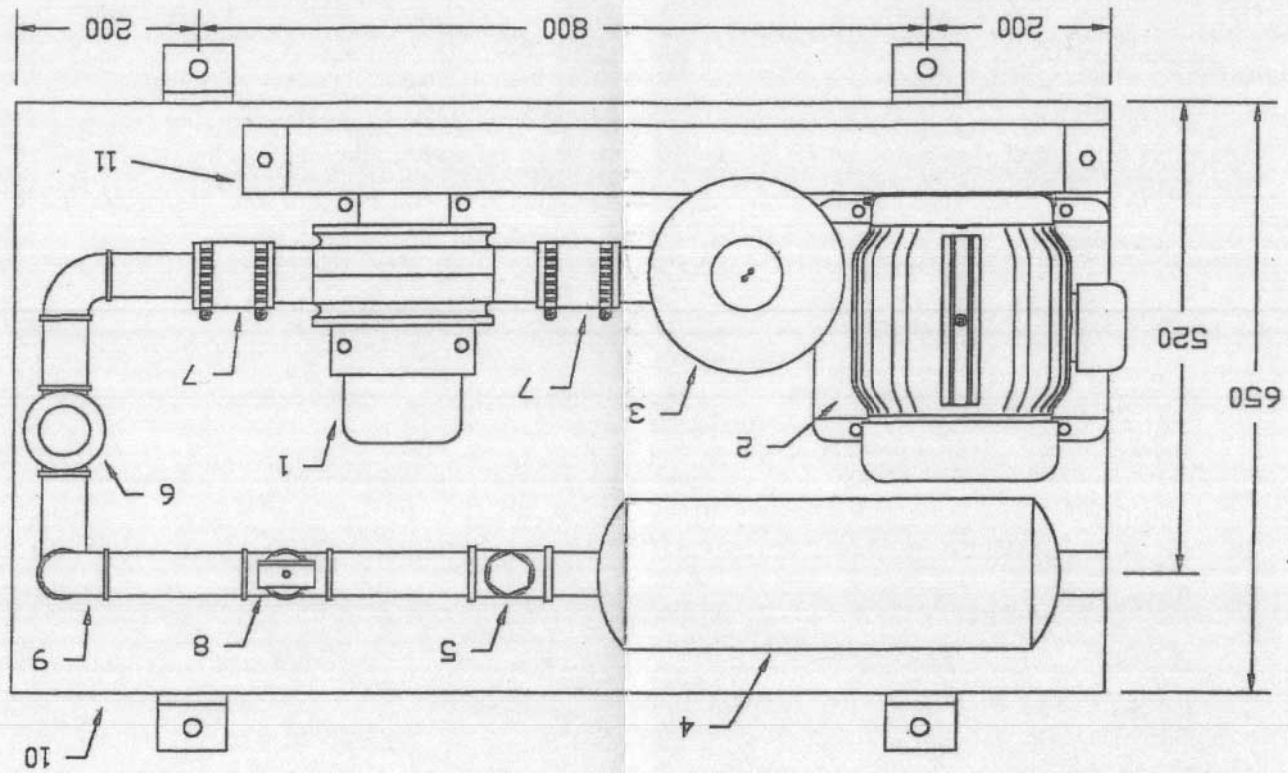
METRIC DRAWING
ALL DIMENSIONS IN MILLIMETERS

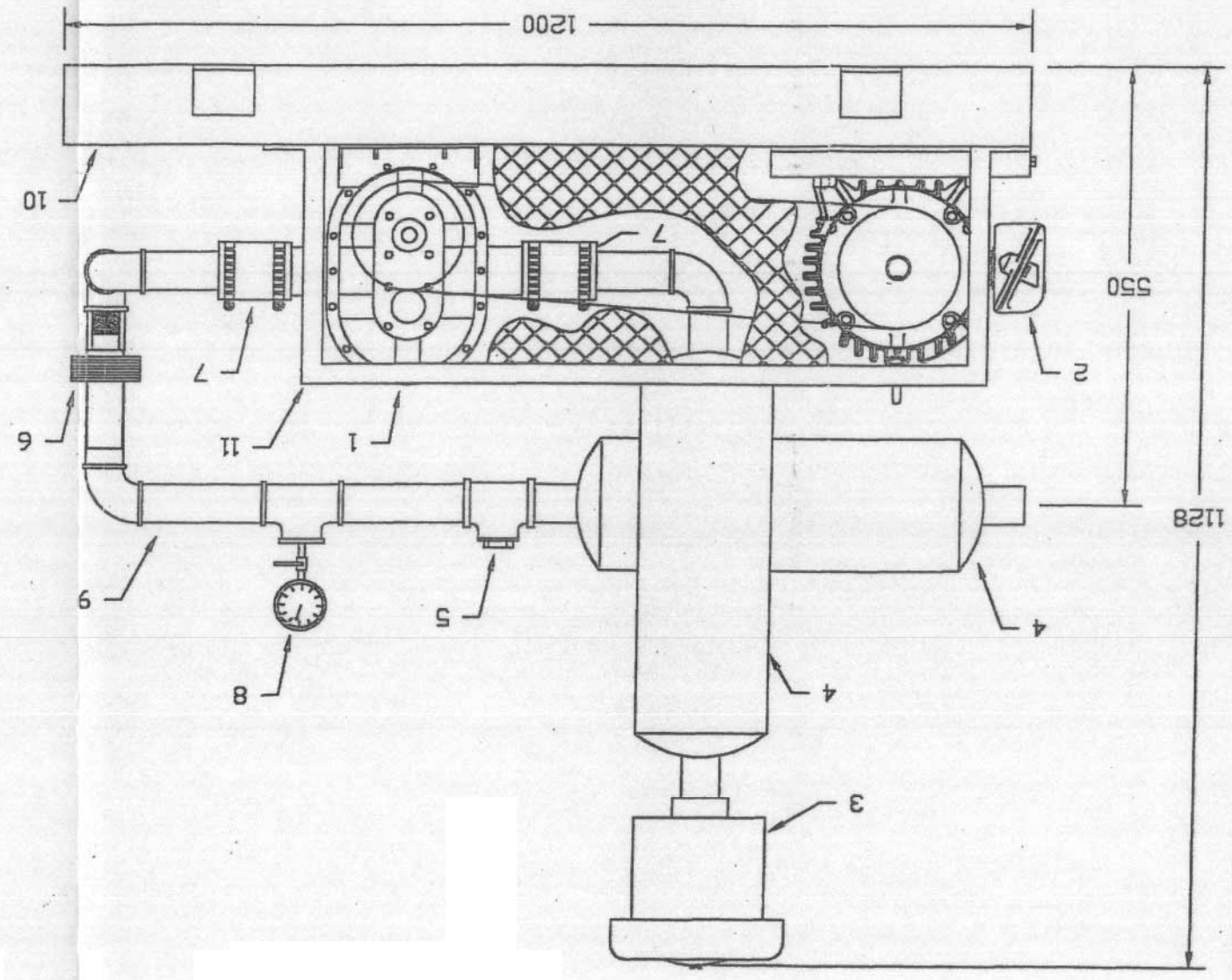
SPECIALTY EQUIPMENT LTD.

TITLE: BCA INDUSTRIAL CONTROLS

SUTORBILT 3 MV-P / 5HP

SCALE	TYPE	SIZE	SHEET 1 OF 1	DWG. No. 47487	REV.
NTS	D	D			O





(7)

ITEM	QUAN.	DESCRIPTION
1	1	SUTORBILT 3MV-P BLOWER IN STANDARD CONSTRUCTION
2	1	5HP, 1750 RPM, 575-3-60, TEFC, ELECTRIC MOTOR WITH SLIDE BASE
3	1	UNIVERSAL INLET FILTER / SILENCER MODEL CCS-1.5
4	2	UNIVERSAL SILENCER MODEL URB-1.5
5	1	FORTUNE 1 1/2" BRONZE CHECK VALVE MODEL 170T
6	1	SUTORBILT 1" WEIGHT LOADED RELIEF VALVE SET AT 7.5 PSI
7	2	ROLLEE FLEX CONNECTORS MODEL SW88-215
8	1	2 1/2" LIQUID FILLED PRESSURE GAUGE WITH ISOLATING BALL VALVE
9	1	STEEL PIPING WITH THREADED FITTINGS
10	1	FABRICATED STEEL BASE WITH ANGLE IRON FEET
11	1	V BELT DRIVE WITH ENCLOSED BELT GUARD

MATERIAL LIST

PART 1 - GENERAL

1.1 References

.1 PVC Pipe: ASTM D1784 and ASTM D1785 NSF International Standards 61.

.2 ANSI B16.5-1981, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.

.3 ANSI B16.21-1978, Nonmetallic Flat Gaskets for Pipe Flanges.

.4 ANSI B18.2.1-1981(R1992), Square and Hex Bolts and Screws.

.5 ASTM A 53-90b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Indicate on manufacturers catalogue literature: air vents,
- .1 Valves
- .2 Piping
- .3 Primer
- .4 Cement

1.3 Maintenance Data

.1 Provide maintenance date for incorporation into manual specified in Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 PVC Pipe

.1 Pipe:
.1 Sched 80 PVC pipe manufactured of 12454B resin.
.2 Flame spread rating: maximum 10 in conformance with CAN ULC S102.2.
.3 Certification:
.1 NSF International Standards 61 for potable water.
.2 Third party certified to CSA B137.3.
.3 To requirements of ASTM D1785 and ASTM D2665.
.4 Operating temperature: to 60degC.
.5 Operating pressure (100dia pipe): 2200kPa at 23degC.
.6 Acceptable material: IPEX Xirtec 140.

.2 Joints:
.1 Socket with solvent joints to manufacturers recommendations.
.2 Flanges: plain face, socket.
.3 Threaded (PVC to PVC only): NPT, socket to PVC. Direct threading of PVC piping is not acceptable.
.4 Flange gaskets: EPDM to ANSI B16.21 or ANSI B16.20.
.5 Bolts and nuts: to ANSI B18.2.1 - 1981(R1992).
.6 Threaded (PVC to other): NPT, socket to PVC, stainless steel reinforced to ASTM D2467.
.1 Acceptable material: Spears SR Fittings.

.3 Fittings (Injection Molded-200dia and smaller unless otherwise noted):
.1 Sched 80 injection molded manufactured to PVC resign with cell classification of 12454B to ASTM D1784.
.2 Certification:
.1 Third party certified to CSA B137.3.
.2 To requirements of ASTM D2466 and ASTM D2467.
.3 Operating pressure and temperature: to match piping.

2.1 PVC Pipe (Cont'd)

.4 Fittings (Fabricated-250dia and larger unless otherwise noted):
.1 Butt fused/welded of segments of PVC pipe with overwrap of FRP reinforced mesh.
.2 Certification:
.1 Pipe segments to be third party certified to CSA B137.3.
.2 To the requirements CSA B137.3.
.3 Fabrication:
.1 Bonding to for FRP mesh to be completed with Primer Resin.
.2 FRP reinforcement to the requirements of CGSB 41.22-93.
.3 Solvent welded bells to be minimum socket depth of one-half pipe diameter.
.4 Testing:
.1 All joints to be tested with spark test of 24 000V power source.
.5 Operating pressure and temperature: to match piping.

.5 Cements and Primers:
.1 Cement:
.1 High strength solvent cement to ASTM D-2564.
.2 Types:
.1 Medium setting rate and medium body suitable up to 300dia.
.2 Slow setting rate and extra heavy body for piping 350dia to 900dia.
.3 Acceptable material: Ipex Xirtec 11/17 and 19.
.2 Primer:
.1 Aggressive PVC primer suitable for use in cold temperatures.
.2 Acceptable material: Xirtec 7 Primer

2.2 Steel Piping

.1 Pipe:

.1 Steel pipe threaded and roll grooved joints: schedule 40 to ASTM A 53-90b, Grade B.

.2 Joints:
.1 50 dia. and under: screwed fittings with teflon tape or jointing component.

2.2 Steel Piping (Cont'd)

.2 Joints:(Cont'd)
.2 63 dia. and over:
.1 Roll grooved: rigid coupling to CSA B242.
.2 Flanges: plain face.
.3 Gaskets:
.1 Blower air systems:
.1 Roll grooved: rated to 177degC operating temperature, Grade L, silicone.
.2 Flanged:
.2 Other:
.1 Roll grooved: EPDM rated to 110degC operating temperature, Grade E.
.2 Flanged: EPDM to ANSI B16.21 or ANSI B16.20.
.4 Bolts and nuts: to ANSI B18.2.1-1981(R1992).

.3 Fittings:
.1 Screwed fittings: malleable iron, Class 150 to ANSI B16.3.
.2 Flanges and flanged fittings:
.1 Cast iron, Class 150: to ANSI B16.1.
.2 Steel: to ANSI B16.5.
.3 Roll grooved: malleable iron to ASTM A47M.
.4 Unions: malleable iron, to ASTM A 47M-90.

2.3 Stainless Steel Piping

.1 Pipe:

.1 Stainless steel pipe, schedule 10S to ASTM A-312.

.2 Joints:
.1 38dia. and over:
.1 Roll grooved: light weight stainless steel coupling to ASTM A351, A743 and A744 Grade CF-8M.
.2 Flanges: plain face.
.2 Gaskets:
.1 Roll grooved: EPDM rated to 110degC operating temperature, Grade E.
.2 Flanged: EPDM to ANSI B16.21 or ANSI B16.20.

2.3 Stainless Steel Piping (Cont'd)

.2 Joints:(Cont'd)
.3 Bolts and nuts: stainless steel to ANSI B18.2.1-1981(R1992).

.4 Fittings:
.1 Flanges and flanged fittings:
.1 Stainless steel: to ANSI B16.5.
.2 Roll grooved: sched 10S type 304 stainless steel to ASTM A403.

2.4 Copper Pipe

.1 Pipe:
.1 50dia and smaller only: copper tube, hard drawn, Type K or L: to ASTM B 88M-93a.

.2 Fittings:
.1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15-1985.
.2 Cast copper, solder type: to ANSI B16.18-1984.
.3 Wrought copper and copper alloy, solder type: to ANSI B16.22.
.4 Wrought copper, grooved fittings to ASTM B 75-93 and ANSI B16.22.

.3 Joints:
.1 General:
.1 Lead free solder.
.2 Teflon tape for threaded joints.
.2 Grooved fittings:
.1 Rigid grooved joint with EPDM gasket, Acceptable Material: Grinnell Fig 7400 Rigidlite.

2.5 Flexible Tubing

.1 Tubing:
.1 flexible PEX-AL-PEX tubing to to CSA B137.10 and ASTM F1281. ANSI/NSF standard 61 for potable water.
.1 Operating temperature: to 99degC
.2 Operating pressure: 793kPa
.3 Acceptable material: Kitec Orange

.2 Fittings:

2.5 Flexible Tubing (Cont'd)

.2 Fittings: (Cont'd)
.1 Brass crimp fitting to CSA B137.9 with double o-ring seal.
.1 Acceptable material: Kitec

2.6 PVC Ball Valves

.1 Body, stem, ball and unions: PVC to requirements of 12454 according to ASTM D-1784.

.2 Seats: Teflon backed by EPDM o-rings.

.3 Seals: EPDM

.4 Features:
.1 Union and blocking both ends.
.2 Limited travel blocking carrier.
.3 Body to be single end entry.
.4 Full port ball.
.5 Lever handle.
.6 Expansion compensation grove on solid end.

.5 Pressure rating:
.1 13dia to 50dia: 1.6MPa at 23degC.
.2 63dia to 100dia: 1.03MPa at 23degC.

.6 Testing: valve to be manufacturer pressure tested in open and closed positions.

.7 End Connections:
.1 Socket: as required.
.2 Flanged: for connection to equipment or flanged valves.

.8 Acceptable material: IPEX VK Series.

2.7 PVC Drain Valves

.1 As per PVC ball valves.

.2 Size: as per drawings , minimum 19dia.

.3 Terminate with line size NPT cap.

2.8 PVC Butterfly Valves

.1 Body: FRP reinforced PP obtained from homopolymer polypropylene.

.2 Disc: CPVC resin to requirements of 23447 according to ASTM D-1784.

.3 Shaft: 420 stainless steel.

.4 Seats: EPDM

.5 Seals: EPDM

.6 Features:
.1 Disc seating by pyramid elastomeric liner boot.
.2 Liner to completely isolate valve body from flow and function as flange gasket on both sides of the valve.
.3 Disc seats and seals to be only wetted parts.
.4 Wafer or lug design.
.5 Locking lever handle.

.7 Pressure rating:
.1 63dia to 100dia: 1.03MPa at 23degC.

.8 Acceptable material: IPEX FK Series Butterfly Valve.

2.9 PVC Swing Check Valves

.1 Body and disc: PVC to requirements of 12454 according to ASTM D-1784.

.2 Disc gasket: EPDM.

.3 Bolts, nuts and washers: 304 Stainless Steel.

.4 Features:
.1 Valve to allow full flow.
.2 Gravity operated.

.5 Pressure rating:
.1 75dia: 689kPa at 23degC.
.2 100dia to 200dia: 480kPa at 23degC.

.6 Acceptable material: IPEX SC.

2.10 Ball Valves (Steel/CU piping)

.1 50dia and smaller:
.1 Class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.
.2 Acceptable material: Kitz Fig 68/Toyo.

.2 63dia and larger:
.1 General: class 150, full bore, side entry design ball valve, flanged.
.2 Body: A216GR WCB carbon steel.
.3 Stem: Type 316 stainless steel.
.4 Ball: Type 316 stainless steel.
.5 Gland: A351 Gr CF8.
.6 Packing and gasket: PTFE
.7 Ball seat: Hypatite PTFE
.8 Handle: ductile iron
.9 Rated maximum operating pressure and temperature: 150degC at 1378kPa.
.10 Acceptable material: Kitz 150SCTBZM

2.11 Drain Valves (Steel/CU piping)

.1 Class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.
.1 Size: As noted on drawings, minimum 19dia.
.2 Acceptable material: Kitz /Toyo.

2.12 Spring Check Valves (Steel air piping)

.1 Body: ductile iron to ASTM A536

.2 Door: bronze to ASTM B148

.3 Lug bearing: teflon

.4 Spring, stop pin and hinge pin: 316 stainless steel.

.5 Hinge and stop pin retainers: steel

.6 General: wafer design for ANSI flanges, spring loaded, normally closed, phenolic red oxide primer finish.

2.12 Spring Check Valves (Steel air piping) (Cont'd)	.7	Acceptable material: APCO Series 9000A Double Door Check Valve.
2.13 Flow Meters	.1	Electro-magnetic, flanged sensor.
	.2	Remote mounted transmitter.
	.3	Provided FOB, Pangnirtung by BCA.
2.14 Flexible Connection	.1	As per Section 15516.
2.15 Pressure Gauges	.1	As per Section 15130.

PART 3 - EXECUTION

3.1 Piping Installation (General)	.1	Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
	.2	Install to conserve headroom and space. Run exposed piping parallel to walls.
	.3	Slope piping at 1:1200 in direction of flow for drainage and positive venting unless otherwise noted.
	.4	Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
	.5	Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
	.6	Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

3.1 Piping Installation (General) (Cont'd)

.7 Assemble piping using fittings manufactured to ASTM standards.

.8 Equip low points with drain valves.

.9 Group piping wherever practical for trapeze hangers.

3.2 Piping Installation (PVC)

.1 Follow piping manufacturers recommendations and directions for all PVC piping installation.

.2 All PVC piping layout, fitting and joints to be completed at a minimum temperature of 15degC regardless of primer and cement temperature ranges.

.3 All piping is to be protected from direct sunlight and cold conditions prior to layout, fitting and completion of joints. Piping surface temperatures to be approximately equal to surrounding space temperature.

.4 Specified cements and primers are recommended general duty only. Where conditions or piping requires cements and primers that vary from the specified products obtain direction from the Engineer prior to proceeding. All fittings to be completed with solvent based cements manufactured in accordance with ASTM D 2456.

.5 Complete all joints to the recommended practices for making solvent cemented joints described in ASTM D2885.

.6 Standard of practice for handling of primers and cements shall be in accordance with ASTM F402.

.7 Ends of pipe to be cut square and bevelled to 15 degree chamfer to allow cement flow, all dirt, grease and gloss finish removed.

.8 All joint ends of pipe and sockets to be primed with approved piping primer prior to solvent cementing.

3.2 Piping Installation (PVC) (Cont'd)

.9 Apply solvent cement with manufacturer recommended applicators only as follows:
.1 Up to 25dia: 19mm dauber.
.2 19dia to 50dia: 25mm brush.
.3 19dia to 75dia: 38mm dauber.
.4 75dia and larger: brush 1/2 diameter of piping.

.10 Apply cement only after piping has been correctly primed and while primer is still wet.

.11 While inserting solvent cement joints ensure minimum 1/8 turn to a recommended 1/4 turn of pipe relative to fitting. Provide mechanical devices as required.

.12 Secure fitted joint for minimum 30 seconds to eliminate pushout. Provide mechanical devices as required.

.13 Cure all joints to manufacturers recommendations.

.14 Do not handle joints during initial set time.

3.3 Pipe Application

.1 Pipe type for process piping identified on plans and schematics. Where pipe type is not identified request clarification from Engineer.

3.4 Valves

.1 Install valves with stems upright or horizontal unless approved otherwise by Engineer.

.2 Install valves at serviceable elevation unless otherwise noted.

.3 Install specified valves as noted on plans and schematics.

.4 Provide swing check valves on discharge of pumps as indicated.

3.4 Valves (Cont'd)

.5 Provide ball drain valves at low points of piping for complete system drainage.

3.5 Testing

.1 As per Section 15011 Piping and Duct Testing and Mechanical Startup.

3.6 Flow Meters

.1 Install as per manufacturers recommendations and as indicated.

.2 Mount remote transmitter in immediate vicinity of sensor as directed by BCA.

.3 Provide minimum 5 diameters straight piping upstream of sensor and minimum 2 diameters downstream from all fittings and changes of direction.

.4 Sensors are to be installed in piping that will be continuously flooded during operation. Where concerns over flooding of piping are evident during construction advise Engineer for additional direction.

3.7 Cleaning (Steel Air Piping)

.1 Blow out all piping to clean interior thoroughly of all oil and foreign matter.

3.8 Flushing and Cleaning (Other)

.1 Complete all leakage tests before flushing and cleaning.

.2 Flush all process piping thoroughly before system commissioning and startup by BCA. Flush for a minimum of 30 minutes with clean potable water so that all deleterious material is removed.

END

PART 1 - GENERAL

1.1 References

.1 American National Standards Institute (ANSI).
.1 ANSI/ASME B16.1-1989, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
.2 ANSI/ASME B16.3-1992, Malleable-Iron Threaded Fittings, Classes 150 and 300.
.3 ANSI B16.21-1978, Nonmetallic Flat Gaskets for Pipe Flanges.
.4 ANSI B18.2.1-1981(R1992), Square and Hex Bolts and Screws.

.2 American Society for Testing and Materials (ASTM).
.1 ASTM A 53-90b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

PART 2 - PRODUCTS

2.1 Steel Pipe

.1 Pipe:
.1 Steel pipe threaded, roll grooved or welded joints: schedule 40 to ASTM A 53-90b, Grade B.

.2 Joints:
.1 50 dia. and under: screwed fittings with teflon tape or jointing component.
.2 63 dia. and over:
.1 Roll grooved: rigid coupling to CSA B242.
.3 Flanges: plain face, slip-on or weld neck.
.4 Gaskets:
.1 Flanged: EPDM to ANSI B16.21 or ANSI B16.20.
.2 Roll grooved: EPDM rated to 110degC operating temperature, Grade E.
.5 Bolts and nuts: to ANSI B18.2.1-1981(R1992).

.3 Fittings:
.1 Screwed fittings: malleable iron, Class 150 to ANSI B16.3.

2.1 Steel Pipe (Cont'd)

.3 Fittings: (Cont'd)
.2 Flanges and flanged fittings:
.1 Cast iron, Class 150: to ANSI B16.1.
.2 Steel: to ANSI B16.5.
.3 Roll grooved: malleable iron to ASTM A47M.
.4 Unions: malleable iron, to ASTM A 47M-90.

2.2 Terminal Unit Runouts and Hydronic Heat Trace

.1 Tubing:
.1 25dia and smaller, concealed on terminal unit runouts and hydronic heat trace only: flexible PEX-AL-PEX tubing to to CSA B137.10 and ASTM F1281.
.1 Operating temperature: to 99degC
.2 Operating pressure: 793kPa
.3 Acceptable material: Kitec Orange
.2 Provide 9dia for all hydronic heat trace tubing.

.2 Fittings: Brass locking nut fitting to CSA B137.9.
.1 Acceptable material: Kitec K1

PART 3 - EXECUTION

3.1 Piping Installation

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls.

.3 Slope piping at 1:1200 in direction of flow for drainage and positive venting.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

3.1 Piping Installation (Cont'd)

.6 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

.7 Assemble piping using fittings manufactured to ANSI standards.

.8 Equip low points with drain valves and high points of piping with air vents.

.9 Group piping wherever practical for trapeze hangers.

.10 Provide nonconducting isolators where joining dissimilar metals.

.11 Drops in partition walls adjacent to exterior walls to be minimum 300 mm from exterior wall in interior partition walls.

.12 Use of flexible tubing is acceptable on terminal unit runouts only from the isolation and control valve terminations.

3.2 Flushing and Cleaning

.1 As per Section 15545.

3.3 Testing

.1 Test system in accordance with Section 15010 - Mechanical General Requirements.

.2 For glycol systems, retest with specified quality of glycol after cleaning. Repair any leaking joints, fittings or valves.

3.4 Balancing

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Refer to Section 15990 - Testing, Adjusting and Balancing for applicable procedures.

3.5 Heat Trace Tubing

.1 Install securely to piping as indicated on details using nylon tie-wraps installed at maximum 600mm spacing.

.2 Secure tubing to HW piping using specified fittings only.

.3 Tubing to be continuous for full lenght of heat trace loops. Use of joints NOT acceptable uless approved by Engineer.

END

PART 1 - GENERAL

1.1 References

.1 ASME Section VIII for Unfired Pressure Vessels, 1983.

.2 ASTM A 47M-90, Specification for Ferritic Malleable Iron Castings.

.3 ASTM A 278M-93, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 345°C.

.4 ASTM A 516/A 516M-90, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate and Lower Temperature Service.

.5 ASTM A 536-84(1993), Specification for Ductile Iron Castings.

.6 ASTM B 62-93, Specification for Composition Bronze or Ounce Metal Castings.

.7 CSA B51-M95, Boiler, Pressure Vessel, and Pressure Piping Code.

.8 MSS-SP-70-1984, Cast Iron Gate Valves, Flanged and Threaded Ends.

.9 MSS-SP-71-1984, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.10 MSS-SP-85-1985, Bronze Gate, Globe, Angle and Check Valves.

.11 NSS-SP-85-1985, Cast Iron Globe and Angled Valves, Flanged and Threaded Ends.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Indicate on manufacturers catalogue literature: air vents,
- .1 Air vents
- .2 Valves
- .3 Strainers
- .4 HW expansion tank

1.3 Maintenance Data

.1 Provide maintenance date for incorporation into manual specified in Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 Diaphragm Type Expansion Tank

.1 Cylindrical steel pressurized diaphragm type expansion tank.

.2 Capacity:
.1 Main Tank: total volume = 329 L. acceptance volume = 135 L.
.2 Heat Trace: total volume = 7.6 L, acceptance volume = 3.8 litres.

.3 Diaphragm sealed EPDM suitable for 115 deg. C operating temperature.

.4 Working pressure: 862 kPa.

.5 Air precharged to 84 kPa.

.6 Acceptable Material:
.1 Main Tank: Amtrol Extrol SX-160V.
.2 Heat Trace: Amtrol Extrol Model 15.

2.2 Automatic Air Vent

.1 Standard float vent: brass body and 3 dia. connection and rated at 690 kPa working pressure.

2.3 Manual Air Vent

.1 Brass body, 3 dia connection, screwdriver operated, 860kPa working pressure.

2.4 Air Separator Vortex Type

.1 Vortex type vertical air seperator with tangential nozzles, NPT tappings, fabricated steel or cast iron body.

.2 Ratings: minimum 1100kPa at 177degC.

.3 Connections: NPT independent vent and blowdown, flanged inlet and discharge.

2.4 Air Separator Vortex Type (Cont'd)

.4 Acceptable Material: Armstrong VAS

2.5 Air Separator - In-Line (Hydronic Heat Trace)

.1 Working pressure: 1030 kPa.

.2 Size: line size.

.3 Acceptable Material: Amtrol Series 400.

2.6 Strainer

.1 Bronze body(50dia and smaller) :
.1 Class 150, 1033 kPa, Y-pattern, screwed cap, stainless steel screen, bronze body, screwed.
.2 Acceptable material: Kitz Fig 15/Toyo.

.2 Iron body (63dia and larger):
.1 Class 125, 860 kPa, Y-pattern, bolted cover, stainless steel screen, flanged ends.
.2 Acceptable material: Kitz Fig 80/Toyo.

.3 Strainers to be line size.

2.7 Butterfly Valves

.1 Provide for all heating isolation valves 63 dia. and larger.

.2 Ductile Iron body, ductile iron disc, EPDM seat rated to 135degC, 416 stainless steel shaft, ruberized bronze bushing, rated to 1378kPa shut off and Class 125 flange pattern, lever operator with multiple position locking handle.
.1 Acceptable material: Centerline Series 200.

2.8 Ball Valves

.1 Provide for all heating isolation valves 50 dia. and smaller.

.2 Class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.
.1 Acceptable material: Kitz Fig 68/Toyo.

2.9 Drain Valves

.1 Minimum 13dia, class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.
.1 Acceptable material: Kitz /Toyo.

2.10 Globe Valves

.1 Bronze body to MSS-SP-80, Class 125, 860 kPa, screwed bonnet, renewable teflon disc, swivel type disc holder, screwed.
.1 Lock shield handles as indicated.
.2 Acceptable material: Kitz Fig 11/12/Toyo.

2.11 Swing Check Valves

.1 Bronze body to MSS-SP-80, Class 125, 860 kPa, swing type, Y-pattern, screwed cap, integral disc, screwed.
.1 Acceptable material: Kitz Fig 22/23/Toyo.

.2 Iron body, Class 125, 860 kPa, swing type, bolted cover, flanged ends, bronze trimmed.
.1 Acceptable material: Kitz Fig 78/Toyo.

2.12 Balancing Valve /Flow Measuring Station

.1 Hydronic circuit balancing valve c/w pressure differential read-out ports.

.1 Standard of Acceptance: Armstrong CBV-T or CBV-S circuit balancing valves. Size as indicated on drawings.

2.13 Radiation Globe Valves

.1 Class 100, bronze body, globe radiator valve c/w piggy back drain valve.
.1 Acceptable material: Dhal.

2.14 Pump Combination Check/ Flow Balancing Valve

.1 Angle or straight pattern, for full sized shut off, non slam check valve, flow throttling valve, EPDM seat, ductile iron body, bronze disc, NPT brass body meter ports, grooved flange connection with EPDM gasket.
.1 Sizes:
.1 As indicated.
.2 Acceptable Material: Armstrong Flotrex FTV.

2.15 Inline Pump Strainers

.1 Straight pattern strainer, cast iron body, cast iron cover, stainless steel strainer, fine mesh brass strainer for start up, steel guide vanes.
.1 Sizes:
.1 As indicated.
.2 Acceptable Material: Armstrong SG.

2.16 Hydronic Heat Trace Heat Exchanger

.1 Brazed plate, cover and channel plates, connections, type 316 stainless steel to ANSI 316, copper brazed, chevron design.

.2 Maximum design to 3102 kPa at 190 deg C.

.3 Capacity:
.1 Cold side: (Glycol): 0.16 l/s, EWT: 60C, LWT: 69.7C.
.2 Hot side: (glycol): 0.11 l/s, EWT: 82C, LWT: 71C.

.4 Acceptable material: ITT plateseal model 400-10.

PART 3 - EXECUTION

3.1 General

.1 Install as indicated and to manufacturer's recommendations.

.2 Maintain proper clearance to permit service and maintenance.

.3 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.4 Refer to manufacturer's installation drawings.

.5 Check that all openings for appertunances and equipment operating weight conform to shop drawings.

3.2 Strainers

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install as noted on drawings.

3.3 Air Vents

.1 Install at high points of systems.

.2 Install automatic air vents in mechanical room only. Provide pet cocks on all automatic vent connections.

3.4 Expansion Tank

.1 Install level and secure.

3.5 Drain Valves

.1 Install at low points of systems.

3.6 Valves

.1 Install valves with stems upright or horizontal unless approved otherwise by Engineer.

3.6 Valves (Cont'd)

.2 Install specified valves at all branch take-offs and to isolate each piece of equipment, and as indicated.

.3 Install flow measuring stations and flow balancing valves as indicated.

.4 Provide silent check valves in vertical pipes with downward flow and as indicated.

.5 Provide swing check valves on discharge of pumps as indicated.

.6 Provide ball drain valves at low points of piping for complete system drainage.

3.7 Heat Exchanger

.1 Install securely to building structure

.2 Install as per manufacturer's latest instructions.

END

PART 1 - GENERAL

1.1 References

.1 ASTM A 53-90b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A 105/A 105M-94, Specification for Forgings, Carbon Steel, for Piping Components.

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Indicate for each item as applicable:
.1 Manufacturer, model number, line contents, pressure and temperature rating.
.2 Movement handled; axial, lateral, angular and the amounts of each.
.3 Nominal size and dimensions including details of construction and assembly.

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

.2 Data to include:
.1 Servicing requirements, including any special requirements, lubrication and recommended procedures.

PART 2 - PRODUCTS

2.1 Flexible Connection

.1 Approvals:
.1 FO Service: CSA/UL listed for fuel oil service.
.2 Other: CSA approved for service pressure and temperature.

.2 Inner hose: Type 321 stainless steel.

.3 Braided wire mesh Type 301 stainless steel outer jacket.

2.1 Flexible Connection (Cont'd)

.4 Diameter: as indicated.

.5 Connections: to match specified piping joints.

.5 Operating conditions:
- .1 Working pressure: 1034 kPa.
- .2 Working temperature: 93°C.
- .3 To match system requirements.

.6 Minimum lengths:
- .1 Other: 300mm.
- .2 FO Tank: minimum 450mm.

.7 Acceptable material: Hydroflex.

2.2 Expansion Joints

.1 Working pressure: 1375kPa.

.2 Operating temperatures to: 399degC.

.3 Bellows: stainless steel, 2 ply.

.4 Housing: carbon steel with anti-torque key.

.5 Connections: schedule 40 steel pipe, ABSI B16.25 bevel for welding/male pipe thread to suit specified pipe jointing.

.6 Acceptable material: Hyspan Model 8503/8504.

2.3 Guides

.1 Carbon steel, galvanized finish, piping guide.
- .1 Provide one part expoy coating for all Natatorium piping guides. Painting as per Section 09911. Color as directed by Engineer.

.2 Acceptable material: Grinell Fig 255.

PART 3 - EXECUTION

3.1 Installation (General)

.1 Install connections in accordance with manufacturer's instructions.

3.2 Expansion Compensators

.1 Provide guides and bracing as indicated and as required by manufacturer.

3.3 Guides

.1 Install as per manufacturers recommendations and as indicated on drawings.

.2 Provide guides at 4dia and 14dia up and downstream of expansion joints.

END

PART 1 - GENERAL

1.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

.3 Submit shop drawings of pump curves for review showing point of operation.

.4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

1.3 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 15010.

PART 2 - PRODUCTS

2.1 Inline Circulating Pumps

.1 Radially split cast iron body, nonferrous or bronze impeller, sleeve oil lubricated bearings, alloy steel-copper sleeve shaft, mechancial seal.

.2 Design pressure: 1207 kPa.

.3 Capacities:
.1 HW Pumps P-21/P-22: 3.59L/s @ 7.72m.

.4 Motors: (1800 rpm)
.1 HW Pumps P-21/P-22: 0.56kW, 120V/1ph/60Hz.

2.1 Inline Circulating Pumps (Cont'd)

.5 Acceptable Material: Armstrong
.1 Primary HW Pumps P-21/P-22: Armstrong Model H54.

2.2 Heat Trace Circulating Pump P25

.1 Capacity: 0.32 L/S @ 3.1m head

.2 Construction: stainless steel shaft, nylon impellor, steel volute, vent plug.

.3 Motor: 0.13 kW, 115/1/60

.4 Acceptable material: S.A. Armstrong model SSC-50.

PART 3 - EXECUTION

3.1 Installation

.1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges. Install as per manufacturers recommendation.

.2 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.3 Check rotation prior to start-up.

.4 Install pressure gauge test cocks.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section VII-1992.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Provide for the following:
- .1 HW Media and Inhibitors.
- .2 HW Fill Tank.
- .3 Side Arm Filters.
- .4 Sight glass.
- .5 Pot feeder.
- .6 Degreasant.

1.3 Maintenance Data

.1 Provide maintenance data for water treatment equipment for incorporation into manual specified in Section 01300 - Submittals.

1.4 Description of Work

.1 Flushing, cleaning and filling of all HW piping and equipment.

1.5 Water Treatment Specialist

.1 All testing described in this Section to be performed by an independent Water Treatment Specialist to the approval of the Engineer.
- .1 Acceptable firms: SAI Engineering.

PART 2 - PRODUCTS

2.1 HW Fill System

.1 Tank: 180L polyethylene, high density moulded tank with hinged lid and cover.

.2 Pump: diaphragm type, flexible suction hose, inlet strainer, thermal cut-out, integral pressure switch.
.1 Capacity: 0.06L/s @ 345kPa.

.3 Pressure tank: pre charged, EPDM diapragm.

.4 Acessories:
.1 Manual diverter valve for air purging and tank agitation.
.2 Pressure regulating valve. Adjustable 35-380kPa.
.3 Fast fill lever.
.4 Integral strainer.
.5 Check valve.
.6 Isolation valve.
.7 12mmdia x900mL flexible conneciton hose.

.5 Control:
.1 Low Level Pump Cut-Out.
.2 Integral pump pressure control switch.

.6 Power: 120V/60Hz/1ph

.7 Acceptable Material: Axiom SF-100 System Feeder.

2.2 Heating Fluid

.1 Factory premixed with distilled water. Inhibited high temperature low toxicity propylene glycol with advanced inhibitor package suitable for film temperatures to 190 degC. Provide additional molydenum inhibitor to min 50 to max 80ppm factory premixed prior to shipping.

.2 Acceptable material: Supplier premixed Re-formulated Dow Chemicals Dow Frost HD with supplier mixed SAI 8325 Inhibitor.

2.3 Flush and Clean Water	.1	All water for HW system flush and clean to be softened local water.
2.4 Pot Feeder	.1	Carbon steel, rated 2067kPa @ 93degC, with ball isolation flow control valves.
	.2	19dia drain, inlet and outlet.
	.3	25dia chemical fill port.
	.4	Acceptable material: SAI Model HP.
2.5 Side Arm Filters	.1	Acceptable material: Armteck Model #10 Hot c/w sight flow glass.
	.2	Filter wrench: as required for filter change out.
2.6 Sight Glass	.1	Bronze body, 6.5mm thk glass, rated operating pressure to 860kPa.
	.2	Acceptable material: SAI Model 200.
2.7 Boiler and Pipe Degreasant/ Detergent	.1	Phosphate free, concentrated alkaline water softening detergent.
	.2	Acceptable material: SAI BD-86.

PART 3 - EXECUTION

3.1 Flushing and Cleaning

.1 Flush after pressure test for a minimum of 4 hours with local pre-softened water.

.2 Fill with solution of pre-softened water and no-foaming, phosphate-free detergent minimum 3% solution by weight or as per manuf. directions. Heat to minimum 82degC. Circulate for minimum of 48 hours.

.3 During all flush and clean procedures periodically remove strainer screen/basket and side arm filters and clean.

.4 During flush and clean ensure all valves to terminal units and coils left full open.

.5 Drain system periodically from all drain locations and low points until complete cleaning water and detergent replaced with complete fresh softened water.

.6 Continue to circulate clean softened water for minimum 24hrs. Drain and flush with softened water for a minimum 2 hours.

.7 Final flush and clean water PH and TDS to be as per clean softened water. Repeat all steps as necessary until pH and TDS levels meet.

.8 Provide two 1 litre samples of clear water drained from system. Confirm site test levels with test in independent laboratory and provide test results to engineer for review prior to filling of system with final heating media.

3.2 Filling of System

.1 Upon receipt of approval of flushing water test results, fill complete system with clean heat transfer fluid.

.2 Heat transfer fluid to be factory premixed with required quality approved water prior to shipping. Mixture ratio to be as follows: 53% Re-formulated Dow frost HD combined with 47%

3.2 Filling of System (Cont'd)

.2 (Cont'd) water. Additional molydenum inhibitor to be provided factory premixed to required levels.

.3 Provide preliminary adjustment of glycol and inhibitor levels using site test kits.

.4 Provide one sample of adjusted treated heat transfer fluid. Test in laboratory and provide test results.

.5 Modify glycol and inhibitor levels as directed by water treatment analysis to meet product specification.

.6 Provide two final samples. Test one in laboratory and provide test results. Turn over second sample to engineer.

.7 Final heating fluid ratio, inhibitor and pH levels as follows:
.1 Ratio: 50% gylcol/50%water by volume.
.2 Molydenum inhibitor: 50-80 ppm.
.3 pH: 8.5-10.5.
.4 reserve alkalinity:

3.3 Testing HW Media

.1 All heating water media tests to be performed to and include the following standards:
.1 Specific gravity - ASTM D 1122-94.
.2 Reserve Alkalinity - ASTM D 1121-93.
.3 PH 50% volume solution - ASTM D 1287-91.
.4 Freeze point, 1:1 Dilution - ASTM D 1177-94.
.5 Freeze point, maximum, 50% solution - ASTM D 1177-94.
.6 Dissolved Iron.
.7 Phosphate.
.8 Refractive Index.
.9 Appearance.
.10 Colour.
.11 Copper.
.12 Hydrate.
.13 Ortho phosphate.
.14 Sediment Identification.

3.4 Spare HW Media and Corrosion Inhibitors

.1 Provide the following spare parts. Reference Section 15010:
.1 Spare 20L pail of corrosion inhibitor.
.2 Spare sealed 181L drum of specified premixed HW media.

3.5 Side Stream Filters

.1 Install as per manuf. directions with isolation ball valve, radiator globe valve and sight glass.

.2 Provide filter wrench as required for filter change out.

3.6 Water Softener

.1 Provide softened water for system flushing and cleaning.

.2 Provide temporary water softener and brine tank as required.

END

PART 1 - GENERAL

1.1 References

.1 CAN/CSA-B139-M91, Installation Code for Oil Burning Equipment.

.2 CAN-4-S602-M81, Inside tanks for oil burner fuel.

.3 ANSI/API 650-1992, Tanks.

.4 CGSB 1-GP-140M-78, Primer, Red Lead, Iron Oxide, Oil Alkyd Type.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Indicate details of construction appurtenances installation.

.3 Provide for FO tanks.

PART 2 - PRODUCTS

2.1 Indoor Oil Storage Tanks TK2.2

.1 Capacity: 454L.

.2 Construction: horizontal tank indoors to CAN/ULC-S602-M92.

.3 Sheet steel to conform to ASTM A 569/A 569M-91a(1993) 569M-91a(1993) or equivalent.

.4 Tank to be welded to CSA W59-1989.

.5 Connections: 6 minimum pipe thread welded. Sizes: as follows and as indicated.

.1 Vent: 50 mm dia.
.2 Supply: 50 mm dia.
.3 Fill: 50 mm dia.
.4 Drain: 25 mm dia.
.5 Level Gauging: 50 mm dia.
.6 Level Switches: 2@ 19 mm dia.
.7 Return: 50 mm dia.

2.1 Indoor Oil Storage Tanks TK2.2 (Cont'd)

.6 Finishes: Factory applied, one coat red enamelized metal primer.

.7 Tank to be c/w factory fabricated ULC approved nameplate.

.8 Saddles: fabricated of ASTM A2836 sheet steel.

.9 Acceptable material: Clemmer Day Tank Model 11520/Westeel.

PART 3 - EXECUTION

3.1 Installation

.1 Install tanks in accordance with CAN/CSA-B139-M91 and CAN/CSA-B139-M91.

.2 Position tanks using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

.3 Install tanks in concrete containment dykes. Min dyke capacity to be 110% of total tank volume. See drawings for details.

3.2 Field Quality Control

.1 Test tanks for leaks in presence of authority having jurisdiction.

3.3 Touch-up

.1 Where coating is damaged, touch-up with original coating material.

END

PART 1 - GENERAL

1.1 References	.1	CAN/CSA-B139-M91, Installation Code for Oil Burning Equipment.
	.2	ULC-S601-93, Steel, Aboveground Horizontal Tanks for Flammable and Combustible Liquids.
	.3	ANSI/API 650-1992, Tanks.
	.4	CGSB 1-GP-140M-78, Primer, Red Lead, Iron Oxide, Oil Alkyd Type.
	.5	ULC/ORD-C142.3.
	.6	ULC UCL-S630-93.
1.2 Shop Drawings	.1	Submit shop drawings in accordance with Section 01300 - Submittals.
	.2	Indicate details of construction appurtenances and installation literature for the following: .1 Main FO tank

PART 2 - PRODUCTS

2.1 Main Exterior Storage Tank TK2.1	.1	Capacity: 4.5m3.
	.2	Entire assembly including tank and secondary containment assembly to be ULC listed and constructed to ULC UCL-S630-93 and tested to ULC/ORD-C142.3.
	.3	Tank shall be vented to atmosphere and be equipped with emergency venting.
	.4	Secondary containment shall be provided by complete secondary enveloping the main tank shell.
	.5	Fill point shall be located in a min 10 1 locking leak proof spill box.

2.1 Main Exterior Storage Tank TK2.1 (Cont'd)

.6 A float activated shut off assembly shall be provided to prevent filling above 95% tank capacity.

.7 OHS approved stair and handrail complete with non-skid platform.

.8 Interstitial space vent opening and access hatch shall be provided.

.9 Factory applied paint shall be one coat red oxide primer applied to CGSB-1-GP-140M. Two final coats of polyurethane protective coating. Colour to be selected by Engineer. Total unit shall be sand blasted to SSPC-SP6 standard prior to painting.

.10 Sheet steel to ASTM A 635/A 635M-93 635M-93 or equivalent.

.11 Mechanical antisyphon valve with dip tube.

.12 Connection:
- .1 Vent 75 mm dia.
- .2 Fill 100 mm dia.
- .3 Emergency Vent: as required.
- .4 Level gauging: 50 mm dia.
- .5 Suction: 50 mm dia.
- .6 Spare: 50 mm dia.

.13 Acceptable material: Westeel Model FV45, Clemmer.

PART 3 - EXECUTION

3.1 Installation

.1 Position tanks using lifting lugs and hooks, and where necessary use spreader bars. Use of chains in contact with tank walls will not be acceptable.

.2 Tanks to be installed secured to structural foundation with approved anchors. See structural drawings for foundation details.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV, 1992.

.2 CSA B51-M95, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 CAN/CSA-B139-M91, Installation Code for Oil Burning Equipment.

.4 CSA B140.7.2-1967, Oil-Fired Steam and Hot Water Boilers for Commercial and Industrial Use.

1.2 Shop Drawings

.1 Indicate the following:

.1 General arrangement showing terminal points, instrumentation test connections.
.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
.3 Foundations with loadings, anchor bolt arrangements.
.4 Piping hook-ups.
.5 Equipment electrical drawings.
.6 Burners and controls.
.7 All miscellaneous equipment.
.8 Flame safety control system.

.2 Engineering data to include:

.1 Performance data at 100%, design capacity.
.2 Radiant heat loss at 100% design capacity.

1.3 Permits

.1 Obtain all required installation permits from the Authority having jurisdiction prior to commencing installation.

.2 Maintain installation permits on site at all times. Provide to Engineer upon request.

PART 2 - PRODUCTS

2.1 General

.1 Packaged boiler:
.1 Complete with burner and necessary accessories and controls.
.2 Factory tested at rated capacity and bearing seal or nameplate certifying compliance with, CSA B140.7.2-1967.
.3 Designed and constructed to ASME Boiler and Pressure vessel Code.
.4 CRN (Canadian Registration Number), to CSA B51-M95.

.2 Performance:
.1 Ratings: in accordance with Hydronics Institute (HYDI).
.2 Boiler efficiency: 80% minimum at 100% firing rates.
.3 Flue gas temperature leaving boiler:
.1 Not to exceed 260 deg.C.
.2 Above dewpoint conditions at minimum firing rate.

.3 Electrical:
.1 Electrical components: CSA approved.

.4 Thermal insulation:
.1 50 mm thick mineral fibre.

.5 Jackets: heavy gauge metal, finished with heat resisting paint.

.6 Mounting: as indicated.

.7 Temporary use by contractor:
.1 Contractor may use boilers for his own purposes only after written approval from Engineer.
.2 Monitor and record continuously, all maintenance carried out and performance.
.3 Refurbish to as-new condition before final inspection and acceptance.

2.2 Cast Iron Boilers B1.1, B1.2

.1 Sectional cast iron forced/balanced draft firing, waterwall design, complete with combustion chamber, front plate and removable panels.

.2 Design of boiler to provide balanced water circulation and flue gas travel.

.3 Flue passages to be readily accessible without use of special tools.

.4 Provide supply and return headers, elbows to manufacturers recommendations and to suit installation.

.5 Include mud holes, inspection and cleanout handholes.

.6 Capacities:
.1 B-1 & B-2: Gross IBR output 224kW, burner capacity 24.6L/hr No2 FO.

.7 Acceptable material:
.1 B-1 & B-2: Weil McLain Model BL-778-WF.

2.3 Auxiliaries

.1 Provide for each boiler and to meet ASME requirements.

.2 Hot water boilers:
.1 ASME rated relief valves, set at 345 kPa, to release entire boiler capacity.
.1 Acceptable material: Watts.
.2 90 mm diameter pressure gauge and shut-off cock.
.3 115 mm diameter thermometer: range 10 to 150 deg.C.
.4 Float type low water cut-off with manual test.
.1 Acceptable material: McDonnel Miller.
.5 Drain valve: 19 dia.
.6 One 1 set of cleaning tools.

2.4 Oil Burners - High-Low Firing

.1 General:

.1 Pressure-mechanical Atomizing, forced draft, with built-in blower to supply combustion air, complete with silencer and damper, two stage oil pump driven by blower motor, complete with integral relief valve and filter, pressure gauge, high voltage ignition transformer, flame observation port.
.2 Provide easy access to nozzle/electrode assembly.

.2 Control:
.1 Electronic combustion control relay with scanner to control combustion and to supervise flame. Control to shut off fuel within 5 s upon flame failure or upon signal of a safety interlock and to ensure, when restarted, in sequence, ignition and supervision of burner operation.
.2 Minimum two immersion controllers:
.1 Operating controller: to start and stop burner, operating between adjustable set points.
.2 High/low controller or in combination with operating controller: to shift burner operation to high fire from low fire on set point.
.3 High limit controller: to lock out burner at high temperature. Manual reset.
.4 Controller range: 38 to 121 deg. C.
.3 Selector switch: to permit manual or automatic firing at low and high fire.
.4 Pilot light: to indicate normal burner operation and each stage of burner operation.
.5 Burner: to start up on low fire position.

.3 Electrical: fract kw, 120V/1ph/60Hz.

.4 Acceptable material: Power Flame WCR1 O L-H-L

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with ASME Boiler and Pressure Vessels Code Section IV, CAN/CSA-B139-M91 regulations of Authority having jurisdiction, and manufacturers recommendations.

.2 Make all required piping connections to all inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system and to CAN/CSA-B139-M91.

3.2 Mountings and Accessories

.1 Safety valves and relief valves:
.1 Run discharge from each valve and terminate discharge pipe as indicated.

3.3 Cleaning

.1 Degrease and flush boilers using ASME standard procedures and an approved degreasing compound prior to connection to heating system.

3.4 Start Up

.1 Contractor to:
.1 Certify installation.
.2 Start up and commission installation.
.3 Carry out on-site performance verification tests.
.4 Demonstrate operation and maintenance.

.2 Submit written report of inspections and test results.
.1 Report to include measurements of: % carbon dioxide, % oxygen, % excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, % stack loss, % combustion efficiency, smoke, over fire draft, last pass draft, and oil pressure to burner.

3.4 Start Up (Cont'd)

.2 (Cont'd)

.2 Test results to meet the recommended values as provided by the manufacturer and the requirements of CAN/CSA-B139-M91.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Clearly indicate following:
- .1 Methods of expansion.
- .2 Details of thimbles.
- .3 Base and intermediate supports.
- .4 Guy details.
- .5 Exit cone.
- .6 Flange details.

1.2 Maintenance Data

.1 Submit product data in accordance with Section 01300 - Submittals.

1.3 Certification of Ratings

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 Breechings

.1 Shop fabricated mild steel, welded, with sweep bends from boiler outlet to chimney as indicated. Thickness as per SMACNA HVAC Duct Construction Standards.

2.2 Pressure Chimney

.1 General: sectional, gas tight, expansion compenstating without the requirement of bellows, factory built, ULC labelled, liquid/gas fuel rated to 760 degrees C for pressure and force draft appliances.

.2 Seal: primary gas seal graphite gasket factor installed to inner liner.

.3 Insulation: 50mm thickness high temperature mineral wool insulation.

2.2 Pressure Chimney (Cont'd)

.4 Liner:type 304 stainless steel.

.5 Shell: type 304 stainless steel.

.6 Couplings: mated couplings with collar.

.7 Fittings for each chimney:
.1 Base lateral tee with cap and drain.
.2 Exit cone.
.3 Roof flashing, collar and roof brace.
.4 Radiation sheilds at each floor penetration.
.5 Base and intermediate supports as required.

.8 Acceptable material: Industrial Chimney VIP.

2.3 Chimney Accessories

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated to SMACNA.

.2 Hangers and supports: in accordance with recommendations of SMACNA and as indicated.

2.4 Breeching Connectors

.1 Flange connections at boiler discharge and chimney connections formed of mild steel of min gauge of breeching. Provide approved high temp gasket.

PART 3 - EXECUTION

3.1 Installation

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at maximum 1.5 m centres and at each joint.

.3 Support chimneys at bottom, roof and intermediate levels as indicated.

.4 Install radiation shields where penetrating roof, floor and ceiling.

3.1 Installation (Cont'd)

.5 Install flashings on chimneys penetrating roofs.

.6 Install exit cones and cleanouts on all chimneys.

END

PART 1 - GENERAL

1.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Indicate:
.1 Equipment, capacity, piping, and connections.
.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

1.2 Maintenance

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 Unit Heaters

.1 Casing: 18 gauge cold rolled steel, gloss enamel finish, with threaded connections for hangers rods.

.2 Coils: single aluminum fins mechanically bonded to tubing.

.3 Fan: direct drive propeller type, factory balanced, with anti-coorosive finish and fan guard, aluminum blades.

.4 Motor: speed as indicated totally enclosed shaded pole built-in overload protection, and resilient motor supports.

.5 Air outlet for horizontal type: two-way adjustable louvres, projection.

.6 Air outlet for vertical type: opening circular which encircles full depth of fan blade for protection against damage.

2.1 Unit Heaters (Cont'd)

.7 Capacity and type: based on EWT=82.2degC, LWT=65.6degC, max WPD=0.5m.
.1 UH-1, UH-2, UH-3, UH-6: 10.0kW, 720L/s, 0.12KW/120V/1PH/60Hz. Horizontal.
.2 UH-4, and UH-5: 10.0kW, 543L/s, 0.12KW/120V/1PH/60Hz. Vertical.
.3 UH-7, and UH-8: 4.3kW, 342L/s, 0.12KW/120V/1PH/60Hz. Horizontal.

.8 Acceptable Material:
.1 UH-1, UH-2, UH-3, UH-6: Rosemex H-60/ Sterling / Trane / Engineered Air.
.2 UH-4, and UH-5: Rosemex V-48/ Sterling / Trane / Engineered Air.
.3 UH-7, and UH-8: Rosemex H-32/ Sterling / Trane / Engineered Air.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and reviewed shop drawings.

.3 Check final location with Engineer if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.4 Valves: for each unit, install ball valve and control valve on inlet and radiator valve on outlet of each unit. Install drain valve at low point. Install manual air vent at high point.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Before acceptance, set discharge patterns and fan speeds to suit requirements.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/ARI 430-89, Standard for Central Station Air Handling Units.

.2 CAN/CGSB-1.181-92, Coating, Zinc-Rich, Organic Ready Mixed.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate following: fan, fan curves showing point of operation, motor drive bearings, filters, dampers, coil plus all relevant performance data including selection points and acoustic data.

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

1.4 Manufactured Items

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 - PRODUCTS

2.1 Units General

.1 Factory assembled components suitable for site jointing to form units supplying air at designed conditions, as indicated.

.2 Certify ratings: Unit shall bear CSA/NRTL seal.

.3 Horizontal type, as indicated, having air tight modular components, consisting of casing, fan sections with motors and drives, filter sections, mixing section with dampers,

2.1 Units General (Cont'd)

.3 (Cont'd)
heating coil, sensible heat recovery pipe, and stratification eliminators as noted on drawings.

.4 Acceptable Material:
.1 Haakon.
.2 Trane Custom.
.3 Engineered Air.
.4 Silent Aire.
.5 Scott Springfield..

2.2 Casings

.1 Exterior wall panels: minimum 16Ga galvanized G90 steel.

.2 Inner liners:
.1 Fan Sections: minimum 22ga galvanized plate steel.
.2 Economizer and mixing box: minimum 22ga perforated galvanized plate steel.
.3 Coil section: minimum 22ga perforated galvanized plate steel.
.4 All other sections: minimum 22ga galvanized perforated plate steel.

.3 Insulation:
.1 Fibrous glass duct liner: air stream side faced with mat facing and edge coating.
.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102-M88.
.3 Suitable for velocities to 1829 mpm.
.4 Mold growth: to ASTM C665, G21, G22 will not support mold growth.
.5 Water vapour sorption: less than 3% weight to ASTM C1104.
.6 Density: 24 kg/m^3 minimum.
.7 Thermal resistance to be minimum 0.70 W/m. deg.C for 25 mm thickness when tested in accordance with ASTM C 177-85(1993), at 24 deg.C mean temperature.

.8 Acceptable Material: Knauf Liner EM.

.4 Internal liner shall be suitable for high humidity applications without risk of wetting

(Cont'd)

.4 (Cont'd) insulation. Liner to be installed over top of panel flanges and seam to be sealed with lap joint. Wall liners to be instaled over top of case water dam to ensure run off onto water tight base.

.5 Wall and roof seams shall be turned inward to provide clean flush exterior finish.

.6 Seal all panel seams during assembly. All panels to be mechanically fastened and sealed with butyl sealant between joints.

.7 Protect insulation edges with metal lagging.

.8 Silicone seal all panel seams after unit has been painted.

2.3 Base Construction

.1 Unit to be installed on common base rail. Rail to be fabricated of structural steel channel. Unit of 6.1m length or less to have minimum 100mm channel. Units of greater than 6.1m length to have minimum 150mm channel.

.2 Unit base to be fabricated of panel construction as per sub 2.2.

.3 Provide 38 mm perimeter collar around the entire unit, and around each floor opening to ensure the unit is internally watertight.

.4 Provide auxiliary drains in fan sections and in mixing sections.

.5 All drain connections on floor mounted air handling units to terminate at the side of the unit.

2.4 Access Doors

.1 Access doors to be manufactured from galvanized steel. The doors shall be double wall construction with 22 gauge solid/perf metal liner on the inside to match casing and

2.4 Access Doors (Cont'd)

.1 (Cont'd)
16 gauge outside. Corners of the doors shall be continuously welded for rigidity. Two inch 24 kg/cu.m density insulation to be sandwiched between the outer layer and the 22 gauge inner layer.

.2 Two "Ventlock" latches operable from either side of door to be provided. Door opening to be fully gasketted with continuous 13 mm closed cell hollow round black gasket with metal encapsulated reinforced backing that mechanically fastens to the door frame. Door frames shall be made from 16 gauge galvanized steel with the outside of the door flush with the unit.

.3 Locate access doors to permit unrestricted access into unit.

.4 Doors located in sections under positive pressure to open inwards.
.1 Provide warning labels on exterior of unit.

.5 Provide access doors for all sections as follows: Pre / Final filter, mixing section, supply and return fan plenums, H/C and C/C access sections, heat pipe access.

2.5 Fans

.1 Supply and exhaut fans: DIFC fan shall incorporate heavy gauge reinforced steel inlet plate, structural steel frame, and shaft and bearings to AMCA. Each fan shall be run fully assembled at the factory, prior to shipment, at the operating RPM or the maximum class RPM. The total fan assembly shall be checked for balance and compared against the acceptable levels on the Rathbone Chart.

.2 Fan Wheels: All fan wheels shall have spun inlet cones providing a minimum separation in airflow. Blades shall be die formed airfoil or forwards curved shape as identified. All blades shall be continuously welded to the Inlet cones as well as the backplates. No partial welding will be acceptable.

2.4 Access Doors (Cont'd)

.2 Fan Wheels: (Cont'd)

Wheels shall have cast iron hubs. All wheels shall be "true" lined, statically and dynamically balanced on precision electronic balancers. Each wheel shall be designed for critical speeds of at least 1.25 times the maximum class speed.

.3 Fan Shafts: Solid AISI C-1040, or C-1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy. All shafts must be dial indicated for straightness after the keyways are cut and straight as required.

Shafts shall have first critical speeds at least 1.35 times the maximum speeds of the fan.

.4 Bearings: All fans are to have heavy duty, grease lubricated, precision anti-friction ball or roller, self-aligning, pillow block type bearings. Bearings are to be selected for minimum average bearing life of L50, in excess of 400,000 hours when operating at maximum catalogued class conditions. All bearings shall be equipped with re-greasable fittings and where necessary, extended lube lines for easy access for relubrication. Lines to be clear plastic for viewing of grease to fittings.

.5 Guards: belt guards to be minimum 16Ga expanded metal screen and frame on outboard edege of all drives. Provide tacometer access holes.

.6 Inlet and wheel guards: 16 Ga heavy guage metal screen on all fan inlet cones and plenum fan wheels.

.7 Painting: Each fan component shall be thoroughly sandblasted degreased and de-burred before the application of a rust-preventative blue primer. The final coat shall be a baked epoxy coat applied prior to complete assembly.

2.4 Access Doors (Cont'd)

.8 Motors:

.1 Speed: 1800rpm.

.2 Type:

.1 Constant volume: TEFC.

.2 Variable volume: TEFC, NEMA MG1-1993 Part 31 suitable for use with VFD.

.3 Efficiency:

.1 Motors less than 1.2kW: minimum efficiency 77%.

.2 Motors 1.2kW to 3.73kW: minimum efficiency 86%.

.3 Motors 3.73kW to 7.5kW: minimum efficiency 88%.

.4 Motors 7.5kW to 18.7kW: minimum efficiency 92%.

.5 Motors greater than 18.7kW: minimum efficiency 94%.

.4 All motors to be high power factor for 0.75kW and larger.

.9 Vibration isolation: 50mm spring isolators selected for fan and motor loads.

2.6 Coils

.1 Coils to be fully enclosed within casing and mounted on primed and painted angle iron racks manufactured to allow coils to slide out individually.

.2 Removable coil access panels to be provided to remove coils through casing wall. Coils shall be individually removable towards the access side.

.3 Drain pans to be continuously welded galvanized steel and drain in two directions. Intermediate drain pans to be interconnected with 25 mm drain lines.

.4 Coils to be designed for hot water and chilled water cooling service.

.5 Coils to be certified in accordance with ARI Standard 410-81.

.6 Coils to be hydrostatically tested at 2758 kPa and to be suitable for working pressures and temperatures up to 1379 kPa and 104 deg. C.

2.6 Coils (Cont'd)

.7 Pipe connections to be on the same end, and to be threaded.

.8 Copper tube expanded to full fin collars and cast iron headers for HW, configurated plate type aluminum fins mechanically bonded.

.9 Coil connections shall be extended to the exterior of the unit casing and sealed by the unit manufacturer with rubber grommets and silicone.

2.7 Pre Filters

.1 Pre-filters: 25-30% efficient, pleated, disposable type, non-woven cotton and synthetic fabric media, media support grid and enclosing frame.

.2 Listing: UL Class 2.

.3 Rack: prefabricated channel rack.

.4 Access: lift-out where access is available upstream of the filter, or side out when access is not available.

.5 Maximum acceptable velocity: 2.8m/s.

.6 Acceptable material: Farr 30-30.

2.8 Final Filters

.1 Final Filters: high performance, deep pleated totally rigid and disposable type, high density microfine glass fibre media, media support grid, contour stabilizer and enclosing frame, max thickness 300 mm.

.2 Media: high density microfine glass fibres laminated to a non-woven synthetic backing to form a lofted filter blanket, media shall have an average efficiency 90-95% efficiency and 99% arrestance on the ASHRAE Test Standard (52-76) and an average dust spot arrestance of not less than 98% on that standard.

.3 Listing: UL Class 2.

.4 Holding Frames: factory fabricated of 16 gauge galvanized steel and shall be equipped

2.8 Final Filters (Cont'd)

.4 Holding Frames: (Cont'd) with gaskets and 2 heavy duty positive sealing fasteners. Each fastener shall be capable of withstanding 11Kg pressure without deflection and be attached or removed with the use of Type 8 clips.

.5 Access: Service upstream or downstream of the filter.

.6 Maximum acceptable velocity: 2.5m/s.

2.9 Filter Gauges

.1 Provide magnehelic gauges.

.2 Magnehelic gauges to be accurate to +/-2% of full range.

.3 Sensing probes and shut off valves to be provided for each gauge.

.4 One gauge to be provided for each filter bank.

.5 Gauges shall be factory recessed mounted.

2.10 Aluminum Insulted/Thermally Broken Dampers

.1 Frame: extruded 6063T5 aluminum, 2.03mm thick, 101.6mm deep, insulated with styrofoam on three sides for duct mounting nad four sides for flanged mounting.

.2 Blades: extruded 6063T5 aluminum, internally insulated with expanded polyurethane foam, thermally broken, minimum insulation value 0.4RSI.

.3 Blade and Frame Seals: extruded silicone secured in integral slot with aluminum extrusions.

.4 Bearings: celcon inner bearing, 11mm aluminum hexagon blade pin, polycarbonate outer bearing.

2.10 Aluminum Insulted/Thermally Broken Dampers (Cont'd)

.5 Linkage: frame side, aluminum and corrosion resistan zinc plated steel with slip proiof cup-point trunnion screws. Blade linkage hardware to be installed out of air-stream.

.6 Jack shaft assemblies: to be provided for multiple damper installations.

.7 Operating temperature range: -40degC to 100degC.

.8 Lekage: 25L/s/m2 at 1kPa differential static pressure at -40degC.

.9 Pressure drop: full open 1200x1200 damper not to exceed .007kPa at 5.08m/s.

.10 Certification: AMCA 511.

.11 Application:
.1 O/A and E/A dampers: opposed blade.

.12 Mounting:
.1 O/A and E/A dampers: to suit AHU fabrication.

.13 Acceptable material:
.1 TAMCO Series 9000 SC Thermally Insulated Damper.

2.11 Aluminum Airfoil Dampers

.1 Frame: extruded 6063T5 aluminum, 2.03mm thick, 101.6mm deep.

.2 Blades: extruded 6063T5 aluminum.

.3 Blade and Frame Seals:
.1 Blade: extruded EPDM.
.2 Frame: extruded TPE.
.3 all gaskets in integral slot with aluminum extrusions.

.4 Bearings: celcon inner bearing, 11mm aluminum hexagon blade pin, polycarbonate outer bearing.

.5 Linkage: frame side, aluminum and corrosion resistan zinc plated steel with slip proiof cup-point trunnion screws. Blade linkage hardware to be installed out of air-stream.

2.11 Aluminum Airfoil Dampers (Cont'd)

.6 Jack shaft assemblies: to be provided for multiple damper installations.

.7 Operating temperature range: -40degC to 100degC.

.8 Leakage: 52L/s/m2 at 1kPa differential static pressure at -40degC.

.9 Pressure drop: full open 1200x1200 damper not to exceed .004kPa at 5.08m/s.

.10 Certification: AMCA 511.

.11 Application:
.1 M/A dampers: opposed blade.

.12 Mounting:
.1 M/A dampers: to suit AHU fabrication.

.13 Acceptable material:
.1 TAMCO Series 1000 Airfoil Control Damper.

2.12 Heat Pipe Recovery Coil

.1 General: vertical tube horizontal fin heat heat pipe heat transfer coil.

.2 Ratings: catalogued and published ratings to be obtained from tests carried out by the manufacturer or an independent testing agency signifying adherence to cones and standards in force.

.3 Manufacturer to have a minimum 5 years experience in building heat pipes. Provide list of commissioned projects completed within the past 5 years pre-tender for approval by Engineer.

.4 Fabrication: minimum 16dia or 25mm as required integral finned tube continuous to the tube creating one piece tube and fin design with corrugated Type AC5 corrugated aluminum plate fins.

.5 Capillary wick: circumferential capillary wick on inner tube wall to provide completed wetted surface maximizing heat transfer.

2.12 Heat Pipe Recovery Coil (Cont'd)

.6 Flow seperators: provide to ensure laminar flow within tubes at full design heat transfer capacity.

.7 Refrigerant: Classified to Group 1 CSA B52.

.8 Partition: double hospital grade, isolating exhuast and supply air streams to prevent cross contamination with 25mm closed cell foam filled seal.

.9 Drain pan: on exhaust air stream, continuously welded galvanized steel and drain in two directions. Intermediate drain pans to be interconnected with 25 mm drain lines.

.10 Moisture eliminators: provide downstream of E/A coil as required.

.11 Finish: Heresite P413 phenolic thermosetting resinous coating. Four coats accomplished with degreasing and etching, dipping and backing. Complete coverage of fins, tubes, headers and housing.

.12 Efficiency: not less than 60-65% sensible recovery through certification program conducted in accordance with ASHRAE 84-1991 and ARI 1060 standards.

.13 Face and bypass dampers: air foil as per part 2.10. Bypass dampers to be sized so that total air flow is unchanged in bypass mode.

2.13 Finishes

.1 General: Provide specified finishes as follows for all components unless otherwise noted:

.1 Casing, access doors, base rail, base, air blender, filter racks, drip trays:

.1 Exterior: Painted, Acroycote non isocyanage coating system with Zero induction primer and acrylic enamel final finish. Gloss or semigloss final finish.

.1 Acceptable material: Phillips Paint System or approved equal.

.2 Interior: Painted, Acroycote non isocyanage coating system with Zero

2.13 Finishes (Cont'd)

.1 General: (Cont'd)

.1 (Cont'd)

induction primer and acrylic enamel final finish. Gloss or semigloss final finish.

.1 Acceptable material: Phillips Paint System or approved equal.

.2 Preparations: As per finish manufacturers recommendations.

2.14 Fan Schedule

Unit #	S/A Fan Fan #	Flow (L/s)	ESP (Pa)	TSP (Pa)	Motor (kW)	Voltage (V)
AS-1 (high)	SF-1	1800	125	750	3.75	575
(low)		900	75	187	3.75	575

Unit#	E/A Fan #	Flow (L/s)	ESP (Pa)	TSP (Pa)	Motor (kW)	Voltage (V)
AS-1 (high)	RF-1	1800	125	437	2.25	575
(low)		900	75	112	2.25	575

2.15 H/C Schedule

EWT = 82.2 degC 50% Propylene
LWT = 65.5 degC Glycol/Water

Unit#	Service	Rows-Fin/25mm HmmxLmm	LAT (degC)	EAT (degC)	APD (Pa)
HC1.1	Pre-heat (high)	1 - 9 825 x 950	-15	-42	28
	Pre-heat (low)	1 - 9 825 x 950	-0.6	-42	7
HC1.2	Heating (high)	1 - 8 825 x 950	17.9	-15	28
	Heating (low)	1 - 8 825 x 950	31.4	-15	7

2.13 Finishes (Cont'd)
(Cont'd)

Unit #	S/A Fan Unit # Service	Water (L/S)	WPD (kPa)	(kW)	Air (L/S)
HC1.1	Pre-heat (high)	0.93	3.81	59.5	1800
	Pre-heat (low)	0.93	3.81	45.0	900
HC1.2	Heating (high)	1.07	7.78	71.5	1800
	Heating (low)	1.07	7.78	50.4	900

2.16 HRC Capacity

Unit#	Service	Rows	Fins/ 25mm	E/A Stream EAT(degC)	LAT(degC)
HRC-1	HR(high)	6	12	21(DB)	0(DB)
	(low)	6	12	21(DB)	-1.4(DB)

Unit#	Service	S/A Stream EAT(degC)	LAT(degC)	Recovered (kW)
HRC-1	HR(high)	-15(DB)	6.4(DB)	46.3
	(low)	-15(DB)	9.7(DB)	26.6

Unit#	Service	E/A Stream m/s	APD(Pa)	m2	S/A Stream m/s	APD(Pa)	m2
HRC-1	HR(high)	1.94	95	0.92	1.94	87	0.92
	(low)	0.97	32	0.92	0.97	27	0.92

2.17 SPL Schedule

.1 AHU-1: (band/db)

.1 SF Discharge: 1/102, 2/91, 3/91, 4/87, 5/82, 6/78, 7/74, 8/69.

.2 SF Casing: 1/84, 2/70, 3/58, 4/45, 5/38, 6/31, 7/29, 8/15.

.3 EF Inlet: 1/70, 2/65, 3/69, 4/74, 5/70, 6/67, 7/64, 8/58.

.4 EF Casing: 1/66, 2/62, 3/51, 4/44, 5/35, 6/29, 7/27, 8/12.

2.18 Component

.1 Unit dimensions and layout: see drawings.

.2 Component schedule: see drawings.

PART 3 - EXECUTION

3.1 General

.1 Provide for installation, commissioning and warranty for all AS.

.2 Install as per manufacturers recommendations level and secure on concrete housekeeping pad.

.3 Provide for startup of AS's minimum one week prior to TAB.

.4 Provide for sheaves as required for final air balancing.

3.2 Operating Set Points

.1 AS-1:
.1 Min O/A=100%
.2 Max O/A=100%

3.3 Unit Dimensions and Additional Costs

.1 Unit dimensions and motor sizes are provided based on Scott Springfield Custom Units. If unit dimensions, weights or motor sizes differ from specified materials advise Engineer.

.2 Additional payments for changes to building structure, housekeeping pad dimensions, sheet metal changes or electrical services will not be entertained due to changes in unit dimensions, weights and sizes.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/ARI 430-89, Standard for Central Station Air Handling Units.

.2 CAN/CGSB-1.181-92, Coating, Zinc-Rich, Organic Ready Mixed.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate following: fan, fan curves showing point of operation, motor drive bearings, filters, packaged heat recovery system, coil plus all relevant performance data including selection points and acoustic data.

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

1.4 Manufactured Items

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 - PRODUCTS

2.1 Units General

.1 Factory assembled components suitable for site jointing to form units supplying air at designed conditions, as indicated.

.2 Certify ratings: Unit shall bear CSA/NRTL seal.

.3 Horizontal type, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive,

2.1 Units General (Cont'd)

.3 (Cont'd)
filter section, and heating coil as noted on drawings.

.4 Acceptable Material:
.1 Haakon.
.2 Trane Custom.
.3 Engineered Air.
.4 Silent Aire.
.5 Scott Springfield.

2.2 Casings

.1 Exterior wall panels: minimum 16Ga galvanized G90 steel.

.2 Inner liners:
.1 Fan Sections: minimum 22ga galvanized plate steel.
.2 Economizer and mixing box: minimum 22ga perforated galvanized plate steel.
.3 Coil section: minimum 22ga perforated galvanized plate steel.
.4 All other sections: minimum 22ga galvanized perforated plate steel.

.3 Insulation:
.1 Fibrous glass duct liner: air stream side faced with mat facing and edge coating.
.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102-M88.
.3 Suitable for velocities to 1829 mpm.
.4 Mold growth: to ASTM C665, G21, G22 will not support mold growth.
.5 Water vapour sorption: less than 3% weight to ASTM C1104.
.6 Density: 24 kg/m^3 minimum.
.7 Thermal resistance to be minimum 0.70 W/m. deg.C for 25 mm thickness when tested in accordance with ASTM C 177-85(1993), at 24 deg.C mean temperature.
.8 Acceptable Material: Knauf Liner EM.

.4 Internal liner shall be suitable for high humidity applications without risk of wetting insulation. Liner to be installed over top of panel flanges and seam to be sealed with lap joint. Wall liners to be instaled over top of

2.2 Casings (Cont'd)

.4 (Cont'd) case water dam to ensure run off onto water tight base.

.5 Wall and roof seams shall be turned inward to provide clean flush exterior finish.

.6 Seal all panel seams during assembly. All panels to be mechanically fastened and sealed with butyl sealant between joints.

.7 Protect insulation edges with metal lagging.

.8 Silicone seal all panel seams after unit has been painted.

2.3 Base Construction

.1 Unit to be installed on common base rail. Rail to be fabricated of structural steel channel. Unit of 6.1m length or less to have minimum 100mm channel. Units of greater than 6.1m length to have minimum 150mm channel.

.2 Unit base to be fabricated of panel construction as per sub 2.2.

.3 Provide 38 mm perimeter collar around the entire unit, and around each floor opening to ensure the unit is internally watertight.

.4 Provide auxiliary drains in fan sections and in mixing sections.

.5 All drain connections on floor mounted air handling units to terminate at the side of the unit.

2.4 Access Doors

.1 Access doors to be manufactured from galvanized steel. The doors shall be double wall construction with 22 gauge solid/perf metal liner on the inside to match casing and 16 gauge outside. Corners of the doors shall be continuously welded for rigidity. Two inch 24 kg/cu.m density insulation to be sandwiched

2.4 Access Doors (Cont'd)

.1 (Cont'd)
between the outer layer and the 22 gauge inner layer.

.2 Two "Ventlock" latches operable from either side of door to be provided. Door opening to be fully gasketted with continuous 13 mm closed cell hollow round black gasket with metal encapsulated reinforced backing that mechanically fastens to the door frame. Door frames shall be made from 16 gauge galvanized steel with the outside of the door flush with the unit.

.3 Locate access doors to permit unrestricted access into unit.

.4 Doors located in sections under positive pressure to open inwards.
.1 Provide warning labels on exterior of unit.

.5 Provide access doors for all sections as follows: Final filter, supply plenum, and H/C sections.

2.5 Supply Fan

.1 Supply fan: DIFC fan shall incorporate heavy gauge reinforced steel inlet plate, structural steel frame, and shaft and bearings to AMCA. Each fan shall be run fully assembled at the factory, prior to shipment, at the operating RPM or the maximum class RPM. The total fan assembly shall be checked for balance and compared against the acceptable levels on the Rathbone Chart.

.2 Fan Wheels: All fan wheels shall have spun inlet cones providing a minimum separation in airflow. Blades shall be die formed airfoil or forwards curved shape as identified. All blades shall be continuously welded to the Inlet cones as well as the backplates. No partial welding will be acceptable.

2.4 Access Doors (Cont'd)

.2 Fan Wheels:(Cont'd)

Wheels shall have cast iron hubs. All wheels shall be "true" lined, statically and dynamically balanced on precision electronic balancers. Each wheel shall be designed for critical speeds of at least 1.25 times the maximum class speed.

.3 Fan Shafts: Solid AISI C-1040, or C-1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy. All shafts must be dial indicated for straightness after the keyways are cut and straight as required.

Shafts shall have first critical speeds at least 1.35 times the maximum speeds of the fan.

.4 Bearings: All fans are to have heavy duty, grease lubricated, precision anti-friction ball or roller, self-aligning, pillow block type bearings. Bearings are to be selected for minimum average bearing life of L50, in excess of 400,000 hours when operating at maximum catalogued class conditions. All bearings shall be equipped with re-greasable fittings and where necessary, extended lube lines for easy access for relubrication. Lines to be clear plastic for viewing of grease to fittings.

.5 Guards: belt guards to be minimum 16Ga expanded metal screen and frame on outboard edege of all drives. Provide tacometer access holes.

.6 Inlet and wheel guards: 16 Ga heavy guage metal screen on all fan inlet cones and plenum fan wheels.

.7 Painting: Each fan component shall be thoroughly sandblasted degreased and de-burred before the application of a rust-preventative blue primer. The final coat shall be a baked epoxy coat applied prior to complete assembly.

2.4 Access Doors (Cont'd)

.8 Motors:
- .1 Speed: 1800rpm.
- .2 Type:
  - .1 Constant volume: TEFC.
- .3 Efficiency:
  - .1 Motors less than 1.2kW: minimum efficiency 77%.
  - .2 Motors 1.2kW to 3.73kW: minimum efficiency 86%.
  - .3 Motors 3.73kW to 7.5kW: minimum efficiency 88%.
  - .4 Motors 7.5kW to 18.7kW: minimum efficiency 92%.
  - .5 Motors greater than 18.7kW: minimum efficiency 94%.
- .4 All motors to be high power factor for 0.75kW and larger.

.9 Vibration isolation: 50mm spring isolators selected for fan and motor loads.

2.6 Coils

.1 Coils to be fully enclosed within casing and mounted on primed and painted angle iron racks manufactured to allow coils to slide out individually.

.2 Removable coil access panels to be provided to remove coils through casing wall. Coils shall be individually removable towards the access side.

.3 Drain pans to be continuously welded galvanized steel and drain in two directions. Intermediate drain pans to be interconnected with 25 mm drain lines.

.4 Coils to be designed for hot water and chilled water cooling service.

.5 Coils to be certified in accordance with ARI Standard 410-81.

.6 Coils to be hydrostatically tested at 2758 kPa and to be suitable for working pressures and temperatures up to 1379 kPa and 104 deg. C.

.7 Pipe connections to be on the same end, and to be threaded.

2.6 Coils (Cont'd)

.8 Copper tube expanded to full fin collars and cast iron headers for HW, configurated plate type aluminum fins mechanically bonded.

.9 Coil connections shall be extended to the exterior of the unit casing and sealed by the unit manufacturer with rubber grommets and silicone.

2.7 Pre Filters

.1 Pre-filters: 25-30% efficient, pleated, disposable type, non-woven cotton and synthetic fabric media, media support grid and enclosing frame.

.2 Listing: UL Class 2.

.3 Rack: prefabricated channel rack.

.4 Access: lift-out where access is available upstream of the filter, or side out when access is not available.

.5 Maximum acceptable velocity: 2.8m/s.

.6 Acceptable material: Farr 30-30.

2.8 Final Filters

.1 Final Filters: high performance, deep pleated totally rigid and disposable type, high density microfine glass fibre media, media support grid, contour stabilizer and enclosing frame, max thickness 300 mm.

.2 Media: high density microfine glass fibres laminated to a non-woven synthetic backing to form a lofted filter blanket, media shall have an average efficiency 85% efficiency and 99% arrestance on the ASHRAE Test Standard (52-76) and an average dust spot arrestance of not less than 98% on that standard.

.3 Listing: UL Class 2.

.4 Holding Frames: factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets and 2 heavy duty positive sealing fasteners. Each fastener shall be capable of withstanding 11Kg pressure without deflection

2.8 Final Filters (Cont'd)

.4 Holding Frames: (Cont'd) and be attached or removed with the use of Type 8 clips.

.5 Access: Service upstream or downstream of the filter.

.6 Maximum acceptable velocity: 2.5m/s.

2.9 Filter Gauges

.1 Provide magnehelic gauges.

.2 Magnehelic gauges to be accurate to +/-2% of full range.

.3 Sensing probes and shut off valves to be provided for each gauge.

.4 One gauge to be provided for each filter bank.

.5 Gauges shall be factory recessed mounted.

2.10 Heat Recovery Package

.1 General: heat recovery package shall consist of heat transfer cassettes, damper section, and interconnecting cassette to damper ductwork, compressor package and integral operating controls.

.2 Ratings: catalogued and published ratings to be obtained from tests carried out by the manufacturer or an independent testing agency signifying adherence to standards in force.

.3 Manufacturer to have a minimum 5 years experience in building heat recovery cassette systems. Provide list of commissioned projects completed within the past 5 years pre-tender for approval by Engineer.

.4 Heat Transfer Cassettes:
.1 Construction: Corrosion resistant alloyed aluminum heat transfer plates, stainless steel frames. Plates to have a

2.10 Heat Recovery Package (Cont'd)

.4 Heat Transfer Cassettes: (Cont'd)

.1 Construction: (Cont'd)
minimum thickness of 0.7mm and a maximum thickness of 0.8mm.

.2 Cassettes to be self cleaning with no filtration requirements and frost free operation. Plates to be cleanable with high pressure wash and capable of field dissassembly for major cleaning.

.3 Efficiency: not less than 90% winter and 85% summer sensible recovery through certification program conducted in accordance with ASHRAE 84-1991 and ARI 1060 standards.

.5 Interconnecting ductwork: double walled construction with 50mm thick insulation between walls.

.6 Drain pan: continuously welded galvanized steel, full floor sloped drain pan per cassette bank with central connection points to facilitate moisture removal.

.7 Damper section: double walled insulated single blade design, EPDM rubber seals, and maintenance free sealed bearing.

.1 Controls: integral control panel to be mounted on top of damper section complete with hinged access door and locking device.

.2 Electrical to be CSA and UL listed with single point connection, factory wired and tested.

.3 Controls to be factory tested and adjusted to suit application.

.8 Acceptable Material: Regent ECO

2.11 Damper Section Compressor

.1 General: oil free air compressor suitable for application.

2.12 Axial Flow Fan

.1 General - Axial flow fan to include housing, fan wheel, shaft, bearings, diffuser section, motor mounting support, and mounting frame as a factory assembled unit. Belt driven with belt guard motor slide rail and integral subbase. All sheet metal parts cleaned, conditioned and painted with enamel primer

2.12 Axial Flow Fan (Cont'd)

.1 (Cont'd)
finish prior to final assembly. A final coat of grey enamel applied to all exterior surfaces after assembly.

.2 Housing - 14 gauge steel hydraulically expended to form integral inlet bell and diffusers section. Hydraulically expanded stiffening rings welded in area of wheel raceway. Outer frame from mounting. Slip-joint duct connections.

.3 Fan Wheel - Precision aluminum casting with eight radially project blades with airfoil cross sections dynamically balanced and keyed to fan shaft.

.4 Diffuser - Cast aluminum diffuser with twenty-nine radially project straightening vanes with airfoil cross section.

.5 Fan Shaft - Solid AISI-C1040 hot rolled steel, turned and polished.

.6 Bearings - Flange-mounted, self-aligning ball bearings at inlet and discharge, grease lubricated and selected for a minimum average life in excess of 200,000 hours at maximum cataloged operating conditions. Grease lines to exterior of fan housing.

.7 Ratings - Tested and rated in accordance with ANSI/AMCA 210-85 and the Certified Ratings Program and bearing AMCA Certified Ratings Seal.

.8 Vibration Isolation - spring type with sound deadening pads and leveling bolts, spring diameter to compressed operating height ratio to be 1 to 1. Isolators to be provided with seismic restraint straps to conform to requirements for Seismic Zone 4.

.9 Motor & Drive - TEFC, size as indicated. Drive sheave to be adjustable, selections and belt lengths to be in accordance with drive manufacturer for specific motor load.

.10 Acceptable material:
.1 RF-1: Trane Model QFAN/Barry Blower/Penn/Twin City.

2.12 Axial Flow Fan (Cont'd)

.10 Acceptable material:(Cont'd)
.1 RF-1:(Cont'd)

2.13 Finishes

.1 General: Provide specified finishes as follows for all components unless otherwise noted:
.1 Casing, access doors, base rail, base, air blender, filter racks, drip trays:
.1 Exterior: Painted, Acroycote non isocyanage coating system with Zero induction primer and acrylic enamel final finish. Gloss or semigloss final finish.
.1 Acceptable material: Phillips Paint System or approved equal.
.2 Interior: Painted, Acroycote non isocyanage coating system with Zero induction primer and acrylic enamel final finish. Gloss or semigloss final finish.
.1 Acceptable material: Phillips Paint System or approved equal.

.2 Preparations: As per finish manufacturers recommendations.

2.14 Fan Schedule

Unit #	S/A Fan Fan #	Flow (L/s)	ESP (Pa)	TSP (Pa)	Motor (kW)	Voltage (V)
AS-1 (Alternate-1)	SF-1	1800	250	690	3.73	575

Unit#	E/A Fan #	Flow (L/s)	ESP (Pa)	TSP (Pa)	Motor (kW)	Voltage (V)
AS-1 (Alternate-1)	RF-1	1800	250		1.12	575

2.15 H/C Schedule

EWT = 82.2 degC 50% Propylene
LWT = 65.5 degC Glycol/Water

2.13 Finishes (Cont'd)
(Cont'd)

Unit # Unit#	S/A Fan Service	Rows-Fin/25mm HmmxLmm	LAT (degC)	EAT (degC)	APD (Pa)
HC1.1 (Alt-1)	Heating	2 - 12 990 x 737	24	-42	70

Unit #	Service	Water (L/S)	WPD (kPa)	(kW)	Air (L/S)
HC1.1 (Alt-1)	Heating	2.19	43.6	143	1800

2.16 HRC Capacity

Unit#	Service	Rows	Fins/ 25mm	E/A Stream EAT(degC)	LAT(degC)
HRC-1 (Alternate-1)	HR(high)	6	12	21(DB)	0(DB)

Unit#	Service	S/A Stream EAT(degC)	LAT(degC)	Recovered (kW)
HRC-1 (Alternate-1)	HR(high)	-15(DB)	6.4(DB)	46.3

Unit#	Service	E/A Stream m/s	APD(Pa)	m2	S/A Stream m/s	APD(Pa)	m2
HRC-1 (Alternate-1)	HR(high)	1.94	95	0.92	1.94	87	0.92

2.17 SPL Schedule

.1 AHU-1: (band/db)
.1 SF Discharge: 1/102, 2/91, 3/91, 4/87, 5/82, 6/78, 7/74, 8/69.
.2 SF Casing: 1/84, 2/70, 3/58, 4/45, 5/38, 6/31, 7/29, 8/15.
.3 RF Inlet: 1/79, 2/85, 3/85, 4/83, 5/82, 6/80, 7/77, 8/69.

2.18 Component

.1 Unit dimensions and layout: see drawings

.2 Component schedule: see drawings.

PART 3 - EXECUTION

3.1 General

.1 Provide for installation, commissioning and warranty for all AS.

.2 Install as per manufacturers recommendations level and secure on concrete housekeeping pad.

.3 Provide for startup of AS's minimum one week prior to TAB.

.4 Provide for sheaves as required for final air balancing.

3.2 Operating Set Points

.1 AS-1:
.1 Min O/A=100%
.2 Max O/A=100%

3.3 Unit Dimensions and Additional Costs

.1 Unit dimensions and motor sizes are provided based on Haakon Custom Unit. If unit dimensions, weights or motor sizes differ from specified materials advise Engineer.

.2 Additional payments for changes to building structure, housekeeping pad dimensions, sheet metal changes or electrical services will not be entertained due to changes in unit dimensions, weights and sizes.

3.4 AHU Alternate1 Site Install

.1 AHU Alternate 1:
.1 Factory supplied:
.1 AHU consisting of cabinet, fan, coil and filter.
.2 Inline return fan.
.3 Silencer section

3.4 AHU Alternate1 Site Install (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.2 Heat transfer package:

.1 Two heat transfer cassettes.

.2 Two insulated interconnecting ducts.

.3 Damper Section

.4 Controls

.3 Compressor suitable for damper section operation.

.2 Field Fabrication and Installation:

.1 Flexible connection and connecting ductwork from AHU inlet to damper section discharge.

.2 Duct connections from damper section to interconnecting ductwork sections.

.3 Ductwork from inlet of damper section to return fan discharge complete with flexible connection

.4 Flexible connection and ductwork to silencer section.

.5 Inlet ductwork from silencer to termination complete with bellmouth.

END

PART 1 - GENERAL

1.1 References	.1	AMCA 99-1986, Standards Handbook.
	.2	ANSI/AMCA 210-85, Laboratory Methods of Testing Fans for Rating.
	.3	AMCA 300-1985 Revised 1987, Reverberant Room Method for Sound Testing of Fans.
	.4	AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
	.5	ANSI/ASHRAE 51-1985, Laboratory Methods of Testing Fans for Rating.
	.6	CAN/CGSB-1.181-92, Coating, Zinc Rich, Organic, Ready Mixed.
	.7	CSA C22.2-94. 113 Fans & Ventilators.
1.2 Shop Drawings and Product Data	.1	Submit shop drawings and product data in accordance with Section 01300 - Submittals.
	.2	Product data to include fan curves and sound rating data, showing point of operation.
	.3	Indicate the following: motors, wheels, bearings, shafts, inlet vanes.
1.3 Operation and Maintenance Data	.1	Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.
1.4 Maintenance Materials	.1	Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 Manufactured Items

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 - PRODUCTS

2.1 In-Line Centrifugal Fans

.1 Casing: heavy gauge galvanized steel, square design, duct mounting collars, removable access panels, 25 mm thick acoustic lining.

.2 Fan: centrifugal backward inclined, aluminum, wheel cone, statically and dynamically balanced.

.3 Motors: heavy duty ball bearing type, belt driven, motor outside of air stream.

.4 Bearings: permanently lubricated and sealed pillow block bearing.

.5 Drives (belt driven): rated to 150% of driven horsepower, adjustable sheaves.

.6 Fans to bear AMCA ratings seal for sound and air performance.

.7 Vibration Isolation: Manufacturer supplied open spring type with sound deadening pads.

.8 Capacity:
.1 SF-1: 225L/s @ 125 Pa ESP, 0.19kW, 120V/1ph/60Hz, 7.5 Sones.

.9 Acceptable material:
.1 SF-1: Penn Vent Model SX100BC /Carnes/Cook/Greenheck.

2.2 Exhaust Fans EF-1

.1 Construction: Belt drive, galvanized steel c/w wall housing.

.2 Fan: axial type sidewall, dynamically balanced, cast aluminum blades and hubs.

2.2 Exhaust Fans EF-1 (Cont'd)

.3 Motor: permanently lubricated, built in thermal overload, 208V/3ph/60Hz.

.4 Fans to bear AMCA certification.

.5 Capacity:
.1 EF-1: 1790 L/s @ 50 Pa, 0.37 kW, RPM =490, Sones 14.2.

.6 Acceptable material:
.1 EF-1:Penn Vent Model BFM30.

PART.3 - EXECUTION

2.3 Fan Installation General

.1 Install fans as indicated, complete with specified vibration isolation.

.2 Install fans with 100 mm flexible connection on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan during running.

.3 Install fan restraining snubbers as indicated.

.4 Flexible connections shall not be in tension when fan running.

END

PART 1 - GENERAL

1.1 References

.1 AMCA 99-1986, Standards Handbook.

.2 ANSI/AMCA 210-1885, Laboratory Methods of Testing Fans for Rating.

.3 AMCA 300-1985 Revised 1987, Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301-1976, Methods for Calculating Ran Sound Ratings from Laboratory Test Data.

.5 ANSI/ASHRAE 51-1985, Laboratory Methods of Testing Fans for Rating.

.6 CGSB 1-GP-181M-77, Coating, Zinc Rich, Organic, Ready Mixed.

.7 CSA C22.2 No. 113 Fans and Ventilators.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Product data to include fan curves and sound rating data, showing point of operation.

.3 Provide coil rating data.

.4 Indicate the following: motors, wheels, bearings, shafts.

1.3 Operation and Maintenance Data

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01300 - Submittals.

1.4 Maintenance Materials

.1 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 Manufactured Items

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 - PRODUCTS

2.1 Fan Coil Unit AHU-2

.1 Certification: Tested and rated in accordance with ARI Standard 430 and ETL listed.

.2 Fabrication: modular unit construciton of heavy guage galvanized steel posts and panels, W-bulb gasketing to UL723 flame burning characteristics between frame channel and unit panel

.3 Panels: Double wall panels of 16Ga G90 galvanized steel frame channels, inner and outerliners and fiberglass insulation glued to outerliner:
.1 Outerliner: 18Ga G90 galvanized.
.2 Inner liner: 20Ga G90 perforated galvanized.
.3 Insulation: 24kg/cum neoprene coated, glass fibre.

.4 Access doors: double walled insulated of similar construction of panels. Heavy duty stainless steel hinges. Factory installed door latch and full size handle. Flush mounted and full perimeter gaskets.

.5 Rails: formed galvanized steel base rail, minimum 102mm to maximum 305mm in hieght as determined by unit weight and dimensions. Integral to unit fabrication.

.6 Coil sections:
.1 Casing: with hinged latching access doors, coil frame of galvainzed steel and galvanized steel drain pan, double slope to drain connection with microbial resistant coating.

2.1 Fan Coil Unit AHU-2 (Cont'd)

.7 Filters Section:
.1 Casing: with racks and hinged latching access doors.

.8 Fans and Fan Section:
.1 General: centrifugal double width, double inlet, forward curved, statically and dynamically balanced, maximum rpm below first critical speed of fan.
.2 Bearings: Sealed self aligning grease lubricated ball bearings, L-50 at 500,000 hours rated. Extended copper lubrication lines for side access of unit near access door and secured to fan base.

.9 Drives:
.1 General: fan and motor on common steel base with removable motor base, common steel base secured to unit spring isolated inside cabinet. with
.2 Isolation: spring with seismic restraint system to Zone 4 requirements.
.3 Balancing: drives and fans dynamically balanced, keyed, adjustable motor sheave. Solid hot rolled steel keyed shaft.
.4 Shafts: dynamically balanced, keyed, solid hot rolled steel.
.5 Sheaves: steel, motor sheave to be adjustable.

.10 Motors:
.1 Speed: 1800rpm.
.2 Type:
.1 Constant volume: TEFC.
.2 Variable volume: TEFC, NEMA MG1-1993 Part 31 suitable for use with VFD.
.3 Efficiency:
.1 Motors less than 1.2kW: minimum efficiency 77%.
.2 Motors 1.2kW to 7.5kW: minimum efficiency 86%.
.4 Power: see schedule.

.11 Heating Coils:
.1 General: Certified to ARI Standard 410-81.
.2 Pressure: Hydrostatically tested at 2758kPa and suitable for working pressures and temperatures up to 1379kPa and 104degC.

2.1 Fan Coil Unit AHU-2 (Cont'd)

.11 Heating Coils:(Cont'd)
.3 Tubes: copper, 16dia on 38mm centers, all joints brazed.
.4 Fins: alumijnum, minimum 0.15mm, mechanically expanded to provide continuous primary to secondary compression bond over entire finned length.
.5 Headers: seamless copper tubing with intruded tube holes.
.6 Frame: channel frame of calvanized steel.
.7 Service: access side service.
.8 Connections: minimum 125mm beyond casing, capped with drain and vent connections. Connections to be factory sealed with gromment and sealant.

.12 Filters:
.1 50mm thickness, pleated disposable non-woven synthetic fabric media with support grid and eclosing frame, UL Class 2 and tested in accordance with UL Standard 900.
.2 Minimum efficiency: 25-30%.

.13 Fan Capacities

Fan#	Service	Flow L/s	ESP Pa	TSP Pa	Motor kW	Voltage
AHU-2	Supply	1800	125	363	3.73	575

.14 Heating Coil Capacities
EWT=82.2degC
LWT=65.6degC
HW Media=P50 Glycol

Coil#	Service	Rows	Fins per m	Area m2	LAT degC	EAT degC
HC2.1	Heating	-	-	0.49	18.5	-40.0

Coil#	Service	Water L/s	WPD kPa	Air L/s	APD Pa	Capacity kW
HC2.1	Heating	1.91	16.0	1800	177	127.6

.15 Unit sound power levels:
.1 Unit: AHU 4:

2.1 Fan Coil Unit AHU-2 (Cont'd)

.15 Unit sound power levels:(Cont'd)
.1 Unit:(Cont'd)

Ref	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Radiated	69	69	61	57	57	47	43	40
Unit out	87	90	85	84	86	82	81	78
Unit in	84	87	82	81	83	79	78	75

.16 Unit component schedule:
.1 Unit: AHU-2
.1 Pre Filter.
.2 Heating coil.
.3 Supply fan.

.17 Unit configuration:
.1 Unit: AHU 2.
.1 See plans.

.18 Acceptable material:
.1 McQuaty Vision Unit Model CAH006FHAC.
.2 Trane Modular Climate Changer.
.3 Haakon Custom.
.4 Engineered Air.
.5 Silent Air.

PART 3 - EXECUTION

3.1 Fan Installation General

.1 Provide for installation, commissioning and warranty for all FCU.

.2 Install fans with 100 mm flexible connection on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan during running. Flexible connections shall not be in tension during running.

.3 Provide for startup of AS's minimum one week prior to TAB.

.4 Provide for sheaves as required for final air balancing.

.5 Provide specified SRS systems.

(Cont'd)

3.2 Unit Dimensions and Additional Costs

.1 Unit dimensions and motor sizes are provided based on McQuay Vision Units. If unit dimensions, weights or motor sizes differ from specified materials advise Engineer.

.2 Additional payments for changes to building structure, housekeeping pad dimensions, sheet metal changes or electrical services will not be entertained due to changes in unit dimensions, weights and size.

END

PART 1 - GENERAL

1.1 References

.1 ASHRAE 52-76, "Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter".

.2 UCL-S111-M95, "Fire Tests for Air Filter Units".

.3 CAN/CGSB-115.10-M90 Filters, Air, Disposable, for Removal of Particulate Matter from Ventilating Systems.

.4 CAN/CGSB-115.18-M85 Filter, Air Extended Area Panel Type, Medium Efficiency

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate the following: filter media, filter racks.

1.3 Certification of Ratings

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 General

.1 Filters: suitable for air at 100% RH and air temperatures between minus 40 and 50°C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated and as noted on drawings.

2.2 SF-1 Filter and Rack

.1 Fiberglass pad filter, 70% arrestance, 25 mm thickness, 176 gm dust capacity.

.2 Acceptable Material: Airguard Standard Grade.

.3 Filter rack: formed light gauge steel furnace filter rack.

PART 3 - EXECUTION

3.1 Installation General

.1 Install in accordance with manufacturers recommendations and as noted.

3.2 Replacement Media

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

END

PART 1 - GENERAL

1.1 References

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 1985.

.2 ASHRAE Handbook, Fundamentals, and Systems Volumes.

.3 ASTM A 480/A 480M-94b, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.4 ASTM A 525M-91b, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. (Metric).

.5 ASTM A 621/A 621M-92(1993), Specification for Steel Sheet and Strip, Carbon, Hot-Rolled, Drawing Quality.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

.2 Indicate following:
- .1 Sealants
- .2 Tape
- .3 Proprietary Joints

1.3 Certification of Ratings

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 Scope of Application

.1 This section applies to all ducts of velocities below 10 m/s and 500Pa.

1.5 Definitions

.1 For purposes of this section:
- .1 "CONCEALED" - insulated duct work in hung ceilings non-accessible chases, furred spaces and crawlspaces.

1.5 Definitions (Cont'd)

.1 (Cont'd)

.2 "EXPOSED" - will mean "not concealed" as defined herein.

1.6 Exposed Ducts

.1 For all exposed galvanized ducts it will be responsibility of the Contractor to meet the aesthetic requirements of the Engineer within the reasonable limits of a tradesman like installation to SMACNA and industry standards.

.2 Where exposed ducts fail to meet the aesthetic requirements of the Engineer the indicated ducts are to be repaired or replaced to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 Seal Classification

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	B

.2 Seal classification:

.1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 Sealant

.1 Concealed: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 deg.C to plus 93 deg.C.

.2 Exposed: latex duct sealant. Temperature range of minus 30degC to plus 93degC.

2.3 Tape

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 Fittings	.1	Fabrication: to SMACNA.
	.2	Radiused elbows: short radius.
	.3	Square elbows: to 400 mm with single thickness vanes.
	.4	Square elbows: over 400 mm with double thickness vanes.
	.5	Main supply duct branches with balancing damper. Provide branch dampers as noted.
	.6	Sub branch duct with 45 deg. entry and balancing damper on branch unless otherwise noted.
	.7	Transitions unless otherwise noted: .1 Diverging: 20 deg. maximum included angle. .2 Converging: 30 deg. maximum included angle.
	.8	Offsets: to SMACMA unless otherwise noted.
	.9	Obstruction deflectors: maintain full cross-sectional area. Maximum included angles as for transitions unless otherwise noted.
	.10	Exposed spiral duct joints: Butt joint. See details.
2.5 Firestopping	.1	Retaining angles all around duct, on both sides of fire separation.
	.2	Firestopping material and installation must not distort duct.
2.6 Galvanized Steel	.1	Lock forming quality: to ASTM A 525M-91b, Z90 zinc coating.
	.2	Thickness: to SMACNA unless otherwise noted.
	.3	Fabrication: SMACNA unless otherwise noted.
	.4	Joints: to SMACNA or proprietary manufactured duct joint.

2.6 Galvanized Steel (Cont'd)

.5 Round:
.1 Exposed and concealed 250dia and larger: single sprial wound.
.2 Concealed less than 250dia: snap lock acceptable alternate.
.3 All exposed: double spiral wound.

2.7 Proprietary Duct Joints

.1 Proprietary manufactured flanged duct joint shall be considered to be a class A seal.

.2 Acceptable material: Ductmate Canada Ltd. system for proprietary joints.

2.8 Hangers and Supports

.1 Hidden ducts:
.1 Round to 500dia and rectangular to 300x200 strap hangers of same material as duct but next sheet metal thickness heavier.
.2 Rectangular ducts larger than 300 x 200 galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA except where SRS required provide angle hangers to SMACNA.
.3 For round ducts 700dia and larger double hanger hanger with formed 6mm thk steel saddle.

.2 Exposed ducts: angle hangers for rectangular,
.1 Rectangular: angle hangers
.2 Round ducts 400 dia and smaller see details.
.3 Round ducts greater than 400dia double hanger with formed 6mm thk steel saddle. Where SRS required for ducts over 700dia provide angle hangers.

.3 Angle hangers to meet the requirements of the following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

2.8 Hangers and Supports (Cont'd)

.4 General hanger installation: to SMACNA unless otherwise noted. Provide angle hangers were required by SRS.

2.9 Upper Attachments-Ducting

.1 Steel channel, joist or angle (bottom):
.1 Malleable iron C clamp to ANSI/MSS SP-58-1983, type 23. ULC listed.
.2 Quick clip malleable steel with threaded rod insert.

.2 Steel channel, joist or angle (top):
.1 Malleable iron top of beam C clamp to ANSI/MSS SP-58-1983, type 19. ULC listed.
.2 Quick clip malleable steel with threaded rod insert.

.3 Concrete:
.1 Insert type expanding anchor with 10dia internal threaded rod connection, galvanized steel, CSTB approved. ULC listed.

2.10 Middle Attachment (rod)

.1 Electro-galvanized carbon steel threaded rod

2.11 Special Hanger Finish

.1 For all duct hanging systems located in sewage treatment plant provide corrosion resistant epoxy painted coating. Painting as per Section 09900. Color black.

PART 3 - EXECUTION

3.1 General

.1 Do work in accordance with SMACNA and as indicated.

.2 Support risers in accordance with SMACNA and as indicated.

.3 Install breakaway joints in ductwork on each side of fire separation.

3.1 General (Cont'd)

.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 Ductwork Routing and Site Verification

.1 Duct work routing as shown on drawings is schematic. Provide all necessary ductwork offsets and fitting in order to route ductwork as indicated within the mechanical drawings.

.2 Verify ductwork routing by review of mechanical and structural steel/architectural drawings prior to ordering and shipping major ductwork elements.

.3 Where a minor conflict between ductwork and other mechanical or electrical services occurs the conflict is to be resolved by rerouting the service that requires the lesser amount of work at no additional cost to the Engineer.

.4 Where a conflict between ductwork and the building structural elements occurs that could have been identified prior to ordering and shipping the duct work elements provide the required remedial work at no additional cost to the Engineer.

3.3 Hangers

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE SMACNA.as follows:

Duct Size (mm)	Spacing (Maximum) (mm)
to 1500	3000
1501 and over	2500

3.4 Sealing

.1 Apply sealant to outside of hidden-duct joint to manufacturer's recommendations.

3.4 Sealing (Cont'd) .2 Exposed ducts: Apply silicone sealant to satisfaction of engineer. Sealant to be suitable for painting. See Arch. In lieu provide standard duct sealant and beauty rings.

3.5 Taping .1 Acceptable at connection between flexible ducts and rigid. Secure in place with plastic tie clip over tape and connection.

3.6 Watertight Duct .1 Provide watertight duct for:
.1 AHU outdoor air intake ducts from hood louvre to AHU.
.2 AHU exhaust air ducts from hood/louvre to AHU.

.2 Form bottom of horizontal duct without longitudinal seams. Seal all joints with duct sealer. Slope to outside or provide drain valve at low point.

3.7 Smoke Detectors .1 Install smoke detectors provided under Division 16 in supply air ducting as per manufacturer's recommendations.

3.8 Joint Beauty Rings .1 Provide beauty rings on all exposed duct joints as per sub 3.4 when standard duct sealant used. Beauty rings to be 22 ga x 75 mm width with flanged and bolted tightening tab. Install tab to be hidden from occupied space.

END

PART 1 - GENERAL

1.1 References .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible (1985).

1.2 Product Data .1 Submit product data in accordance with Section 01300 - Submittals.

.2 Indicate the following:
.1 Flexible connections.
.2 Duct access doors.
.3 Turning vanes.

1.3 Certification of Ratings .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 General .1 Manufacture to SMACNA standards.

2.2 Flexible Connections .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:
.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 deg.C to plus 90 deg.C, density of 1.3 kg/sq.m.

2.3 Access Doors in Ducts .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

2.3 Access Doors in Ducts (Cont'd)

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene or foam rubber.

.4 Hardware:
.1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.
.2 301 to 450 mm: 4 sash locks complete with safety chain.
.3 451 to 1000 mm: piano hinge and minimum 2 sash locks.
.4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.
.5 Acceptable material: Nailor Hart.

2.4 Turning Vanes

.1 Factory or shop fabricated single thickness and double thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.5 Instrument Test Ports

.1 1.6 mm thick steel zinc plated, camlock handles with neoprene expansion plug, 28mm inside dia, length to suit insul thickness, neoprene mounting gasket.

PART 3 - EXECUTION

3.1 Installation

.1 Flexible connections:
.1 Install in following locations:
.1 Inlets and outlets of all AHU.
.2 Inlets and outlets of inline SF.
.3 Elsewhere as indicated.
.2 Length of connection: 100 mm.
.3 Minimum distance between metal parts when system in operation: 25 mm.
.4 Install in accordance with recommendations of SMACNA.
.5 When fan is running:
.1 Ducting on each side of flexible connection to be in alignment.

3.1 Installation (Cont'd)

.1 (Cont'd)

.5 When fan is running:(Cont'd)

.2 Ensure slack material in flexible connection.

.2 Access doors:

.1 Size:

.1 630 x 350 mm for person size entry.

.2 530 x 530 mm for servicing entry.

.3 300 x 150 mm for viewing.

.4 As indicated.

.2 Location:

.1 At fire dampers.

.2 At control dampers.

.3 At devices requiring maintenance.

.4 At locations required by code.

.5 At reheat coils, upstream and downstream of coil.

.6 Elsewhere as indicated.

.3 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

.4 Instrument test ports:

.1 Install in accordance with SMACNA and as per manufacture instructions.

.2 Locations: At inlet and outlet AHU, main and sub main ducts.

END

PART 1 - GENERAL

1.1 References	.1	SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.
1.2 Product Data	.1	Submit product data in accordance with Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 General	.1	Manufacture to SMACNA standards.
2.2 Balancing Dampers (Ducts less than 275mm depth)	.1	Single blade, butterfly type.
	.2	Metal thickness and construction to SMACNA.
	.3	10dia threaded rod, with washer and locking nut, 22mmODx14mmIDxrequried length PVC sleeve for insulated ducts.
	.4	Continuous MIG welded 10dia angle rod handle continuous for full length.
	.5	Handle to extend minimum 50mm from duct wall/insulation for uninsulated and insulated ducts to 25mm thickness and 25mm from insulation for 50mm thickness insulation.
2.3 Balancing Dampers (Ducts 275mm or Greater in Depth)	.1	Factory manufactured of material compatible with duct.
	.2	Opposed blade configuration, metal thickness and construction to recommendations of SMACNA.
	.3	Maximum blade height: 100 mm.
	.4	Bearings: self-lubricating nylon.

2.3 Balancing Dampers (Ducts 275mm or Greater in Depth) (Cont'd)

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 Control Dampers

.1 Fabrication:

.1 Blades maximum 150 mm wide to 1219 mm long.

.2 Provide materials as follows:

.1 Frame: 13 gauge galvanized sheet steel.

.2 Blades: two sheets 22 gauge or 16 gauge galvanized sheet steel.

.3 Bearings: oil impregnated sintered bronze.

.4 Linkage and shafts: zinc plated steel.

.5 Seals: replaceable neoprene seals or ss spring on side, top and bottom of frame and along blade edge and blade ends.

.2 Provide performance characteristics as follows:

.1 temperature range -40 deg C to +90 deg C.

.3 Standards of Acceptance:

.1 Parallel blade: Honeywell D642 low leakage moduflow damper.

2.5 Aluminum Insulted/Thermally Broken Dampers

.1 Frame: extruded 6063T5 aluminum, 2.03mm thick, 101.6mm deep, insulated with styrofoam on three sides for duct mounting nad four sides for flanged mounting.

.2 Blades: extruded 6063T5 aluminum, internally insulated with expanded polyurethane foam, thermally broken, minimum insulation value 0.4RSI.

.3 Blade and Frame Seals: extruded silicone secured in integral slot with aluminum extrusions.

2.5 Aluminum Insulted/Thermally Broken Dampers (Cont'd)

.4 Bearings: celcon inner bearing, 11mm aluminum hexagon blade pin, polycarbonate outer bearing.

.5 Linkage: frame side, aluminum and corrosion resistan zinc plated steel with slip proiof cup-point trunnion screws. Blade linkage hardware to be installed out of air-stream.

.6 Jack shaft assemblies: to be provided for multiple damper installations.

.7 Operating temperature range: -40degC to 100degC.

.8 Lekage: 25L/s/m2 at 1kPa differential static pressure at -40degC.

.9 Pressure drop: full open 1200x1200 damper not to exceed .007kPa at 5.08m/s.

.10 Certification: AMCA 511.

.11 Application:
.1 Generator O/A dampers: opposed blade.
.2 Generator E/A dampers: opposed blade.
.3 AHU Alternate 1 O/A dampers: opposed blade.
.4 AHU Alternate 1 E/A dampers: opposed blade.

.12 Mounting:
.1 Generator E/A dampers: flanged to duct.
.2 Generator O/A dampers: flanged to duct.
.3 AHU Alternate 1 O/A dampers: flanged to duct.
.4 AHU Alternate 1 E/A dampers: flanged to duct.

.13 Acceptable material:
.1 TAMCO Series 9000 SC Thermally Insulated Damper.

2.6 Aluminum Airfoil Dampers

.1 Frame: extruded 6063T5 aluminum, 2.03mm thick, 101.6mm deep.

.2 Blades: extruded 6063T5 aluminum.

2.6 Aluminum Airfoil Dampers (Cont'd)

.3 Blade and Frame Seals:
.1 Blade: extruded EPDM.
.2 Frame: extruded TPE.
.3 all gaskets in integral slot with aluminum extrusions.

.4 Bearings: celcon inner bearing, 11mm aluminum hexagon blade pin, polycarbonate outer bearing.

.5 Linkage: frame side, aluminum and corrosion resistan zinc plated steel with slip proiof cup-point trunnion screws. Blade linkage hardware to be installed out of air-stream.

.6 Jack shaft assemblies: to be provided for multiple damper installations.

.7 Operating temperature range: -40degC to 100degC.

.8 Leakage: 52L/s/m2 at 1kPa differential static pressure at -40degC.

.9 Pressure drop: full open 1200x1200 damper not to exceed .004kPa at 5.08m/s.

.10 Certification: AMCA 511.

.11 Application:
.1 Generator R/A dampers: mixed blade.

.12 Mounting:
.1 Generator R/A dampers: flanged to duct.

.13 Acceptable material:
.1 TAMCO Series 1000 Airfoil Control Damper.

2.7 Backdraft Dampers

.1 Gravity operated, multi leaf, galvanized steel construction, nylon bearings.

PART 3 - EXECUTION

3.1 Installation

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, balancing dampers are to be located in each branch duct.

.4 Each grille, register and diffuser connection to have balancing damper located as close as possible to main ducts.

.5 Provide BDD for all EF & utility fans not provided with control dampers.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/NFPA 90A-1993, Installation of Air Conditioning and Ventilating Systems.

.2 CAN/ULC-S112-M90(R1995), Fire Test of Fire Damper Assemblies.

.3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Indicate the following:
.1 Fire dampers.
.2 Fire damper mounting details.

1.3 Maintenance Data

.1 Provide maintenance data for incorporation into manual specified in Section 01300 - Submittals.

1.4 Maintenance Materials

.1 Provide following:
.1 6 fusible links of each type.

1.5 Certification of Ratings

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 Fire Dampers

.1 Fire dampers: ULC listed and bear label of ULC meet requirements of territorial fire authority and ANSI/NFPA 90A-1993.

.2 Types:
.1 Type 1: curtain in air stream.
.2 Type 2: curtain out of air stream.

.3 Fabrication:
.1 General:Mild steel factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
.2 Chlorine Room: Stainless steel factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.4 Top hinged: round or square; multi-blade hinge or guillotine type; sized to maintain full duct cross section unless otherwise required due to clearances.

.5 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.6 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.7 Acceptable material: Controlled Air.

2.2 Fire Stop Flaps

.1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.

.2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74 °C or as required.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with ANSI/NFPA 90A-1993 and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Coordinate with installer of firestopping.

.5 Install access door adjacent to each damper.

.6 Type 2 FD to be provided except where alternate Type 1 approved by Engineer.

END

PART 1 - GENERAL

1.1 References

.1 ASTM E 90-90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

.2 SMACNA HVAC Duct Construction Standards.

.3 AMCA-Air Movement and Control Association Inc.

1.2 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Provide for the following:
.1 Roof hoods.

1.3 Certification of Ratings

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 Test Reports

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90-90.

PART 2 - PRODUCTS

2.1 Wall Hoods and Roof Goosenecks

.1 As indicated on drawings.

.2 Finish:
.1 Wall hoods: Factory primed and painted finish as per Section 09912.
.2 Goosenecks: Factory primed and painted finish as per Section 09912.

2.2 Wall Caps

.1 Galvanized wall cap c/w BDD and insect screen.

2.3 Roof Hoods

.1 Fabrication: Aluminum sheets, rolled interlocking seams, galvanized steel support members, 13 mm x 13 m bird screen, hinged when 900 x 1200 mm or larger, base to be heavy gauge aluminum.

.2 Finish: factory aluminum.

.3 Sizes and capacities:
.1 RH-1: Throat=600x750 , overall size=850x1200, Capacity = 1790L/s at 0.08Pa.

.4 Acceptable material: Greenheck Fabra Hood. **This is only acceptable material.**

PART 3 - EXECUTION

3.1 Installation

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Coordinate flashings and counter flashings with architectural.

.3 All curb mounted hoods to be provided with additional angle SRS mounting. Provide min 32x32x3 angle screwed to hood and roof curb as per drawing details.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

.2 Indicate the following:
- .1 Capacity.
- .2 Throw and terminal velocity.
- .3 Noise criteria.
- .4 Pressure drop.
- .5 Neck velocity.
- .6 Details of custom manufacturer.
- .7 Finish.

1.2 Manufactured Items

.1 Grilles, registers and diffusers shall be product of one manufacturer.

1.3 Certification of Ratings

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 General

.1 Product to meet capacity, pressure drop, terminal velocity, throw, noise level and neck velocity as indicated.

.2 Colour: as indicated.

.3 Acceptable material: E.H.Price / Titus / Nailor.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.

.3 All prime coated grilles and diffusers to be painted to match Architectural finishes.

.4 All grilles and diffusers to be all aluminimum construction.

.5 Provide grille/diffuser mounted dampers where indicated on drawings. All dampers to be finished in matt black.

3.2 Schedule

.1 Schedule.

Grille Service No.		Model No (EH Price)
S-1	Round Ceiling S/A Diffuser Adjustable **(Not used this project)**	Neck Size: As indicated ARCD/SPL SPL=Color as directed by Engineer
S-2	Small SQ S/A Ceiling Diffuser Adjustable OPD as noted **(Not used this project)**	Face Size: 300x300 Neck Size: As indicated ASCDA/31/3C/SPL SPL=Color as directed by Engineer. Damper: VCR7 as indicated
S-3	Large SQ S/A Ceiling Diffuser Adjustable OPD as noted **(Not used this project)**	Face Size: 600x600 Neck Size: As indicated ASCDA/31/3C/SPL SPL=Color as directed by Engineer Damper: VCR7 as indicated.

3.2 Schedule (Cont'd) .1 (Cont'd)

Grille No.	Service	Model No (EH Price)
S-4	Rectangular S/A Grille	Size: As indicated 520/F/L/-/A/PC15
S-5	Linear Slot Diffuser 13mm single slot Exposed duct **(Not used this project)**	Size: length indicated SDS50/1/16/XX/SPL SPL=Color as directed by Engineer
R-1	Rectangular R/A Grille Eggcrate OPD as noted **(Not used this project)**	Size: as indicated 80(DAL)/N/A/SPL SPL=Aluminimum finish Damper: OPD aluminum, locations as indicated
R-2	Rectangular R/A Grilled Eggcrate, TBar OPD as noted **(Not used this project)**	Size: as indicated 80(BAL)/TB/A/B12 Damper: OPD aluminum, locations as indicated
E-1	Rectangular E/A Grille Eggcrate	Size: as indicated 80/F/-/A/PC15
T-1	Rectangular T/A Grille Heavy Duty Sight proof **(Not used this project)**	Size: as indicated ATGH/BF/SPL SPL=Color as directed by Engineer

END

PART 1 - GENERAL

1.1 Tab Agency

.1 General:
.1 All work described in this section to be performed by qualified TAB Agency. The TAB agency company is to be independent in business to the Division 15 contractor.

.2 Certification:
.1 Current member in good standing of AABC or NEBB, certified to perform specified services.
.2 Submit to Engineer TAB agency and personell for approval within 90 days after award of Contract.
.3 Documentation to confirm qualifications, experience of TAB Agency personnel.

.3 Prequalifed firms:
.1 Dynamic Systems (Whitehorse).
.2 Look HVAC (Yellowknife).
.3 Thermomechanical Systems (Edmonton).

.4 Quality assurance:
.1 Perform TAB under direction of supervisor qualified by AABC/NEBB and to standards of AABC/NEBB.

.5 Co-ordination:
.1 Co-ordinate all work specified in this Section.
.2 Provide all facilities required by TAB Agency in order to carry out work of this Section.

.6 Adequacy of work for TAB:
.1 TAB Agency to review contract documents before work is started and confirm in writing to Engineer adequacy of provisions for TAB and all other aspects of installation pertinent to TAB.

1.2 General

.1 TAB: means to test, adjust and balance all systems to perform in accordance with Contract Documents.

1.2 General (Cont'd)

.2 Follow start-up procedures as recommended by manufacturer unless otherwise specified.

.3 Special start-up procedures may be specified elsewhere.

.4 Notify Engineer 21 days prior to start of TAB.

.5 Operate all systems to permit TAB to be performed.

.6 TAB to apply to systems, equipment and related controls specified in Divisions 13 and 15.

.7 Reference organization standards:
.1 Do TAB over entire operating range in accordance with most stringent conditions of this specification and standard of following organization.
.1 AABC Associated Air Balance Council.
.2 NEBB.
.3 ASHRAE.

.8 Start TAB only when building is essentially completed, including:
.1 Installation of ceilings, doors, windows and other construction affecting TAB.
.2 Application of sealing, caulking and weatherstripping.
.3 All pressure, leakage and other start up tests specified elsewhere in Div. 15 completed unless otherwise authorized by Engineer.
.4 All provisions for TAB are installed and operational.
.5 Start-up, verification for proper, safe and normal operation of mechanical and associated electrical and control systems affecting TAB including, but not limited to, the following:
.1 Proper thermal overload protection in place for electrical equipment.
.2 Air Systems:
.1 Filters in place and in clean condition.
.2 Duct systems clean of debris.
.3 Air shafts, ceiling plenums are airtight to within specified tolerances.

1.2 General (Cont'd)

.8 (Cont'd)

.5 (Cont'd)

.4 Correct fan rotation.

.5 Fire and volume dampers in place and open.

.6 Coil fins cleaned and combed.

.7 Access doors closed and duct end caps in place.

.8 All outlets installed and connected.

.3 Liquid Systems:

.1 Flushed, filled and vented.

.2 Correct pump rotation.

.3 Strainer baskets in place and in clean condition.

.4 Service and balance valves open.

.5 Liquid treatment system operable.

.9 Accuracy tolerances:

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: Plus or minus 10%.

.2 Hydronic systems: Plus or minus 10%.

.2 Measurements to be accurate to within plus or minus 2 % of actual values.

.10 Instrument calibration: to be in accordance with TAB referenced organization standard, but within 3 months of commencement of TAB.

.1 Provide proof of calibration to Engineer.

.11 Adequancy of systems for TAB:

.1 TAB Agency to review contract documents before work is started and confirm in writing to Engineer adequacy of provisions for TAB and all other aspects of installation pertinent to TAB. Identify deficiences to allow corrective action prior to TAB.

.2 Provide written confirmation within 60days of general tender contracto award.

.12 TAB Agenda:

.1 Submit balancing agenda to Engineer minimum 21 days prior to start of TAB.

.2 Commence TAB only upon reciept of approval of agenda.

1.2 General (Cont'd)

.12 TAB Agenda: (Cont'd)

.3 Agenda to include the following:

.1 Methodology and procedures.

.2 Check lists and report forms less field data.

.3 List of instrumentation, including details and certificates of calibration.

.4 General schedule.

.13 Report:

.1 Format to be in accordance with TAB referenced organization standard, but using SI units.

.2 Report to include record full system schematics prepared utilizing ACAD R14 or approved alternate showing results of TAB. All data to be provided in tabular format utilizing Excel or Lotus spread sheets.

.3 Submit, prior to formal submission of TAB reports, for checking and approval by Engineer, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

.4 Draft report: submit 2 draft copies of TAB reports, each in "D" ring binders, complete with index tabs for verification and approval of Engineer.

.5 Final report: upon approval of draft report submitt total of six copies of final report including and changes idenfied in draft submission.

.14 Verification:

.1 Reported measurements shall be subject to verification by Engineer. Provide instrumentation and manpower to verify results of up to 30 % of all reported measurements. Number and location of verified measurements to be at discretion of Engineer.

.2 Bear costs to repeat TAB, as required, to satisfaction of Engineer.

.3 Provide for personell to be on site during contractor building startup and Testing by Engineer.

1.2 General (Cont'd)

.15 Inspections: provide for TAB personell to be on site during the complete execution of the following:
.1 Contractor building startup.
.2 Testing and Startup by Engineer and Interim Inspection.
.3 Systems and Equipment Verification (Commissioning).

.16 Settings: lock and permanently mark settings as required by reference standard and approval of Engineer.

.17 Completion: TAB to be considered complete only when final reports are approved by Engineer.

1.3 Air Moving Systems

.1 General: measurements as required by referenced organization standards, including, but not limited to, following:
.1 Measurements:
.1 Air velocity.
.2 Static pressure.
.3 Velocity pressure.
.4 Temperature:
.1 Dry bulb.
.2 Wet bulb.
.5 Cross sectional area.
.6 RPM.
.7 Electrical power:
.1 Voltage
.2 Current draw.
.3 Size.
.8 Noise.
.9 Pressure.
.2 Location of equipment measurements:
.1 Inlet and outlet of each:
.1 Fans.
.1 All EF, transfer air and cooling fans: design flow
.2 AHU: measurements at design load.
.2 Coils.
.3 Filters.
.4 Main branch dampers and control dampers.
.3 Location of system measurements at:
.1 Main ducts and sub-branches.
.2 Supply outlets.

1.3 Air Moving Systems (Cont'd)

.1 General: (Cont'd)
- .3 (Cont'd)
  - .3 Exhaust inlets.
  - .4 Ducted return inlets.
- .4 AHU outdoor air volumes:
  - .1 Measure O/A volumes for the following conditions:
    - .1 100% O/A

1.4 Hydronic Systems

.1 General: measurements as required by referenced standards, including, but not limited to, following:
- .1 Measurements:
  - .1 Flow.
  - .2 Pressure.
  - .3 Temperature.
  - .4 Specific gravity.
  - .5 RPM.
  - .6 Electrical power:
    - .1 Voltage.
    - .2 Current draw.
    - .3 Motor.
- .2 Location of equipment measurements:
  - .1 Inlet and outlet of each:
    - .1 HW Pumps.
    - .2 DW Pumps.
- .3 Location of system measurements
  - .1 HW flow balancing stations with the following exceptions.
    - .1 HW Terminal units.
  - .2 H/C flow balancing stations.
- .4 Flow Measurement Methodology:
  - .1 Measure flow using approved Armstrong test instrumentation or approved alternate.

1.5 AHU Balance Schedule

.1 AHU 1:
- .1 O/A= 100%.
- .2 S/A= High 1800 L/S
- .3 S/A= Normal 900 L/s
- .4 E/A= High 1800 L/S
- .5 E/A= Normal 900 L/s

.2 AHU 2:
- .1 O/A= 100%.
- .2 S/A= 1800 L/S
- .3 E/A= High 1800 L/S

1.6 Noise Testing

.1 Test space NC levels in the following spaces when all AHU, pumps fans & EF operating at design conditions.
.1 Provide for initial check on SPL utilizing broad-band dbA reading converted to NC/RC ratings. Where rating exceeds ASHRAE standards or where directed by Engineer provide db levels by band.
.2 Provide for the following locations:
.1 Process area

.2 Test radiated equipment noise at 3m from main source for the following locations and equipment while operating:
.1 Fan mezzanine

1.7 Fan Sheaves

.1 Provide for adjustment/replacement of fan sheaves to meet current air balance requirements of EF/AHU.

1.8 Fire Dampers

.1 Provide for drop test of fire dampers by removal of fusible link.

.2 Damper to drop and seal cleanly. Where damper fails test advise Engineer.

.3 Affix seal indicating test completion, date and testing personnel to access door of FD. Where more than one access door provided affix seal to each access door.

END

PART 1 - GENERAL

1.1 Description of Systems

.1 Provide complete building operating systems for systems indicated herein and on the mechanical drawings. The system is to use a combination of networked digital logic based controllers and electronic and electromechanical controllers.

1.2 References

.1 Canadian Standards Association (CSA)
.1 CSA C22.2-94. 0-M91, Canadian Electrical Code, Part II, General Requirements.
.2 CAN/CSA-Z234.1-89, Canadian Metric Practice Guide.

.2 American National Standards Institute (ANSI)
.1 ANSI/ISAS5.5-1985, Graphic Symbols for Process Displays.
.2 ANSI/IEEE260-1978, Letter Symbols for SI and Certain Other Units of Measurements.
.3 CEMA2Y.1.

1.3 Scope

.1 The system specified shall be fully designed, installed and commissioned. The systems is to be installed as a complete package by the controls contractor. The contractor shall furnish all materials, including all controls, wiring, extra starters or relays, and piping. The contractor shall be responsible for the detailed engineering, installation, supervision and labour services, calibration, and commissioning necessary for a complete and fully operational system as specified hereafter. Adjustment and calibration shall be provided as a prerequisite.

1.4 Preliminary Shop Drawings Review

.1 Submit within 14 days of award of contract.

1.4 Preliminary Shop Drawings Review (Cont'd)

.2 Include:

.1 Specification sheets for each item. To include manufacturer's descriptive literature, specification, drawings, diagrams, performance and characteristic curves, catalog cuts, manufacturer's name, trade name, catalog or model number, nameplate data, size, layout, dimensions, capacity, all other data to establish compliance.

.2 General logic diagrams and description.

.3 Controller locations.

.4 Panel layouts.

.5 Control cabinet locations.

.6 Schematic single line diagrams showing cable routing's, conduit sizes, field controllers and systems being controlled, panel layouts.

.7 Valves: schedule listing including following information: designation, service, manufacturer, model, design flow rate, design pressure drop, required Cv, Valve size, actual Cv.

.8 Dampers: schedule listing operator locations, damper sizes, spring return.

1.5 Detailed Shop Drawings

.1 Submit within 30 days after award of contract and before start of installation.

.2 Include:

.1 Corrected and updated versions of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Shop drawings for each piece of equipment including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules and terminations.

.4 Manufacturer's recommended installation instructions and procedures.

1.6 Standards Compliance

.1 All equipment and material to be from manufacturer's regular production, DIN certified, manufactured to standard quoted plus additional specified requirements.

1.6 Standards Compliance (Cont'd)

.2 Where DIN certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Engineer, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by an organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard.

1.7 Qualifications

.1 Control equipment supply and system design shall be the be developed by one qualified contractor using specified manufacturers unless otherwise specified.

.2 Installation of controls to be by approved controls installation firm. All work is to be performed by personnel under the direct supervision of this firm.

.3 Controls contractor to have prior local and regional knowledge in the installation and maintenance of electro-mechanical and digital based PLC control systems. The contractor to have offices staffed by trained personnel capable of the design and installation of the specified systems.

.4 Approved firms and PLC systems:
.1 Honeywell Systems-Excel.

PART 2 - PRODUCTS

2.1 General

.1 Provide all wiring, conduit, relays, starters, electronics, etc., not indicated or specified but required for a complete and functional automatic control system.

.2 Location of controllers and panels not as per drawing locations to be approved by Owner prior to installation.

.3 All scales to be in degrees Celsius.

.4 Operating range to suit application range.

2.2 Line Voltage Thermostatic Controller

.1 Line voltage, spst, heavy duty.

.2 Provide heavy duty metal guard for public access locations.

.3 Acceptable material: Honeywell Series T4051A.

2.3 Modulating Temperature Controller

.1 Proportional temperature controller, 24V, to operate modulating dampers or valves and modulating controller.
.1 Fast response type for discharge air control.
.2 Standard response bulb element for hydronic

.2 Acceptable material: Honeywell T991A.

2.4 Two Position Temperature Controller

.1 Two position, spdt, line voltage to cycle motors, valves/dampers.
.1 Acceptable material: Honeywell T675A.

2.5 Space Heating Thermostatic Controller

.1 Electronic microprocessor based floating control with proportional and integral (PI) control action, 24V, to operate modulating dampers or valves and controller.

.2 Single floating output, one on/off output and dry contact type input for night setback.

.3 Sensor: internal.

.4 Acceptable material: Honeywell T6984D.

2.6 CUH/UH Valves

.1 Two position, 24V, 60Hz, 7.7VA power consumption during valve position change, aluminized case and cover, bronze body, sweat or union fitting.

.2 Size: 19dia.

.3 Acceptable material: Honeywell V8043D.

2.7 Heating Terminal Unit Floating Control Valves

.1 General: complete modulating control valve including actuator and valve.

.2 Actuator:
.1 24Vac, 60Hz, 4W max power consumption during valve position change.
.2 Constructed of moisture and humidity resistant material.
.3 Locking tab to secure actuator to valve body.
.4 Manual opener and position indicator.
.5 1m lead wire cable.

.3 Valve:
.1 Linear flow characteristics.
.2 Bronze body.
.3 Ryton/Noryl cartridge with EPDM O-ring seals.
.4 Stainless steel stem.
.5 Size: Based on indicated flow rates.

2.8 Control Valves (General)

.1 Provide pressure rated valves as indicated or specified. Shut off head shall be 200 kPa.

.2 Provide hot water valves as follows:
.1 Three-Way Mixing: To be piped so that full flow exists on the coil unless otherwise indicated in the power off position. Valve to be sized based on design flow rates indicated on drawings.
.2 Two way: size to be based on design flow rates indicated on drawings.
.3 Indicate CV rating of valves on shop drawings.

2.9 Valve and Damper Actuators (General)

.1 All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with electronic actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close-off.

.2 Where two or more actuators are to be operated in sequence with each other, sequencing shall be by digital sequencing with separate analog outputs, as specified in the sequence of operation.

.3 Provide spring return for "fail-safe" in NC/NO positions as required.

.4 Dampers: Direct coupled to drive shafts only. Connection by drive linkages to dampers is not acceptable.

2.10 Flow Switches

.1 Vane type suitable for low flow applications, spdt, snap acting, line voltage water flow switch, CSA approved.
.1 Acceptable Material: ITT Mcconnel Miller FS4-3.

2.11 Pressure Controller

.1 Line voltage, spdt, adjustable, manual reset.

2.12 Float Level Switches

.1 Non mercury, float, SPDT, line volt.

2.13 Transformers

.1 Provide CSA approved transformers of required kVa and voltage.

2.14 Control Panels

.1 Fabrication: finished steel cabinet type for surface or recessed mounting as indicated, locking handle and gaskets.

.2 Approvals: CSA approved construction.

.3 Finish and mounting:
.1 Finished areas: Type 304 brush finish stainless steel cover, Grey cabinet, white backplate finished. semi-recessed mounted.
.2 Mechanical areas: Blue cover, grey cabinet, white backplate. Surface mounted.

.4 Size:
.1 General:Where panel size inadequate for controllers specified provide two or more connected cabinets as required. For recessed panels minimize panel size and panel depth to be suitable for installation in nominal 100mm thk steel stud wall.
.2 Finished areas: max acceptable size 200xxx200mm.
.3 Mechanical areas: max acceptable size 750mmx900mm.

.5 Wiring: all wiring to be thru common terminal strip(s) located within cabinet.

.6 Pilot lights: solid colour size and type as indicated.

.7 Test/control buttons: intermittent push button type and size as indicated.

.8 Audible alarm: not required.

2.14 Control Panels (Cont'd)

.9 Lamicoids: as per Section 15190. Text as noted on drawings.

.10 Auto dialer: provide auxiliary NO/NC Type C dry contacts for auxiliary automatic dialer operation when indicated. A multi channel auto-dialer is provided as a component of the main process control panel. See Div 16.

.11 Panels interconnection: provide contacts, relays and required equipment for interconnection with remote panels as required.

.12 Alarm and control points: as indicated on drawings. All alarm points to be latching type.

.13 Panel descriptions:
.1 As per attached drawings and controls sequences.

2.15 Selector Switches

.1 General: CSA approved, standard hand knob, non illuminated, gasketted, heavy duty.

.2 Size:30.5mm

.3 Type: 2 or 3 position as indicated.

.4 Contacts and Throws: as required.

.5 Voltage: as required.

.6 Acceptable material: Square D, Allen Bradley.

2.16 Pushbutton Switches

.1 General: CSA approved, spring return, gasketted, full guard, heavy duty.

.2 Size:30.5mm

.3 Contacts and Throws: as required.

.4 Voltage: as required.

	.5	Acceptable material: Square D, Allen Bradley.
2.17 Pilot Lights	.1	General: CSA approved, neon or LED, gasketted, spring return push to test, heavy duty.
	.2	Size:30.5mm
	.3	Colour: as indicated.
	.4	Voltage: as required.
	.5	Acceptable material: Square D, Allen Bradley.
2.18 Relays and Contacts	.1	CSA approved, contacts and throws as required.
	.2	Break/make on time delay as required.
	.3	Acceptable material: Square D, Allen Bradley,
2.19 Wiring	.1	To requirements of Division 16.
2.20 Conduit	.1	To requirements of Division 16.
2.21 Terminations, boxes	.1	To requirements of Division 16.
2.22 Special Supports	.1	Structural grade steel, primed and painted after fabrication and prior to installation.

2.23 Programable Logic Controller (Excel System)

.1 General: Standalone DDC PLC controller with alphanumeric LCD interface panel suitable for connection as integral component of higher order system.

.2 Bus Communications: unit to be suitable for
.1 Option 1: Unit to be suitable for future peer-peer communications on C-Bus networks of up to 30 devices.
.2 Option 2; Unit to be connected to peer-peer C-bus communications network. Provide for required software and hardware to allow communications to central C-bus modem.

.3 I/O Points: unit to provide minimum 7 analog inputs, three analog outputs, two digital inputs and four digital outputs.

.4 Programing: control applications to be based on CARE PC based graphic engineering tool. CARE package to be operate in Microsoft Windows and utilize an object oriented graphic format. CARE to provide standard based libary of energy managemetn functions including:
.1 Duty cycling.
.2 Adaptive heating curve and optimization programs.
.3 PID and PI control functions.

.5 Standalone operator interface: LCD panel of minimum four 16 character (alpha-numeric) lines. All input output operator interfaces to be in real english language data. i.e., discharge air setpoint=21degC. Codes are not acceptable output. All operator keypad points to utilize international symbols in lieu of names. Password protection for the operator interface is a requirement.

.6 Alarm managment: All alarms to be saved to unit buffers which may be downloaded by remote communications or at the operator interface. Alarm description to be multi leveled with all events as high or low priority. Additional alarm features are to include regular maintenance warnings, i.e "filter pressure drop high, change filter".

2.23 Programable Logic Controller (Excel System) (Cont'd)

.7 Battery backup: all RAM to be provided with battery backup for a minimum 1 month period. Unit to periodically test battery and alarm is battery thershold is below acceptable levels.

.8 All programs to be permenately programed into ROM chips.

.9 Communications module: to eanble standalone PLC to communication on specified peer-peer network.

.10 Acceptable material:
.1 PLC: Honeywell XL 50.

2.24 Data Communications

.1 All new and existing PLC's shall be interconnected via primary communications network. All communications shall be via twisted pair of wires. PLC microprocessor failures shall not cause loss of communications of the remainder of the network. The network shall support global application programs and bus-to-bus communications without the presence of a host PC.

.2 The communications network shall support true peer protocol such that each device has equal rights for data transfer and shall report in its token passing time slot. No single device shall be designated as the communications master but each device on the bus shall be capable of taking over the function of bus monitor to assume that the loss of any single device will not cause the total bus failure.

.3 Full communications shall be sustained as long as there are at least two operational devices.

.4 Error recovery and communication initialization routines are to be resident in each bus connected device.

.5 For reliability, maintainability and performance communication, busses shall be

2.24 Data Communications (Cont'd)

.5 (Cont'd) extendable to 4000ft without active links, hubs or repeaters.

.6 Other than for data sharing for dial up communications under no circumstances shall DDC programs be communications system dependent.

.7 All networked PLC to be connected to common communication modem module and controller.

2.25 Communication Modem Module

.1 Auto answer communications shall be provided to allow the digital system to communicate with remote operator terminals on an occasional basis via telephone lines.

.2 Dial up remote operators shall be able to perform all control functions, all report functions and all database generation and modification functions as for local operator terminals connected via RS-232 ports. Routines to be provided to automatically answer calls and display information sent from remote digital system.

.3 Transactions shall not interfere with the local area network or PLC activities.

.4 Both local and remote operators shall be able to access and perform functions with the digital system simultaneously.

.5 Dial up communications shall make use of Hayes compatible auto adjusting max 5300 baud modems and voice quality telephone lines.

2.26 Current Sensor (IR)

.1 Provide sealed current sensor/relay 4-20mA.

.2 Sensor to measure current of three phases where applicable.

2.27 Thermistor Temperature Sensor

.1 The thermistor sensor resistance shall vary proportionally to the temperature being

.2 The twisted shielded cable pair carrying the resistance signal shall not exceed 230 m.

.3 Sensors shall be selected to operate over full range of anticipated control. Max error to be +0.5 deg.C. For O/A sensors min temp to be at least -50 deg.C.

.4 Thermistor temperature sensors shall be of the following types:
.1 General Purpose Duct Type: suitable for insertion into air ducts at any angle, insertion length to be 450mm. Range shall be -50 deg.C to 35 deg.C.

2.28 RTD Temperature Sensor

.1 RTD's shall be 1000ohm at 0deg(+0.2ohm) platinum element with strain minimizing construction and integral anchored lead wires cooefficent of resistivity as required. Operating voltage to be 12 VDC.

.2 Sensing element to be hermetically sealed. Stem and tip constant to be 304 SS.

.3 Sensors to have a time constant response of less than 3sec to a temp change of 10degC.

.4 Sensors shall be selected operate at mid range of the sensors.

.5 Temp sensor (TW) shall be suitable for installation in brass thermowell.

.6 Minimum spec of transmitter:
.1 Input circuit to accept 3 lead, 100ohm platinum resistance detector.
.2 Output signal of 4-20mA into maximum 500ohm load with output/input short circuit and open circuit protection.
.3 Output variation of less than 0.2% of full scale output for supply voltage variations of 10%. Combined non-linearity, repeatability and hysteresis effects not to exceed 0.5% of full scale output.

2.28 RTD Temperature Sensor (Cont'd)

.7 Maximum current to a 100ohm RTD sensor not to exceed 5mA.

2.29 Temperature Transmitters

.1 To following requirements:

.1 Input circuit: to accept 3-lead, 100 ohm at 0C, platinum resistance detectors type sensors.
.2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01C per volt change.
.3 Output signal: 4 - 20 mA into 500 ohm maximum load.
.4 Input and output short circuit and open circuit protection.
.5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.
.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.
.7 Maximum current to 100 ohm RTD sensor: not to exceed 25 mA.
.8 Integral zero and span adjustments.
.9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50C.
.10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.
.11 Transmitter ranges: Select narrowest range to suit application from following:
.1 Minus 50C to plus 50C, plus or minus 0.5C.
.2 0 to 100C, plus or minus 0.5C.
.3 0 to 50C, plus or minus 0.25C.
.4 0 to 25C, plus or minus 0.1C.
.5 10 to 35C, plus or minus 0.25 C.

2.30 Control Relays and Transducers

.1 Control relays and analog output transducers shall be compatible with PCP output signals. Relays shall be suitable for the loads encountered. Analog output transducers shall be designed for precision closed loop control

with repeatability error no greater than 1

2.31 FO Level Switch

.1 CSA/UL Listed for use on FO systems.

.3 Acceptable material: ITT Mcconnel Miller #80.

2.32 Electrical Relays

.1 To following requirements:

.1 Double voltage, DPDT, plug-in type with termination base.
.2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
.3 Contacts: rated at 5amps at 120 V AC.

2.33 Current Transducers

.1 To following requirements:

.1 Range: as indicated on I/O Summaries.

.2 Purpose: to measure line current and produce proportional signal in one of following ranges:
.1 4-20 mA DC.
.2 0-1 volt DC.
.3 0-10 volts DC.
.4 0-20 volts DC.

2.34 Current Sensing Relays

.1 To following requirements:

.1 Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.
.2 Suitable for single or 3 phase metering into single relay.
.3 To have adjustable latch level, adjustable delay on latch and minimum differential of 10% of latch setting between latch level and release level.
.4 3-Phase application: provide for discrimination between phases to allow detection of worst case selection. To be powered from control circuit of motor starter being metered. Relay and base to be mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. All adjustments to be acceptable from auxiliary cabinet.

2.34 Current Sensing Relays (Cont'd)

.1 (Cont'd)
.5 Relay contacts: capable of handling 10 amps at 240 V AC.

2.35 Transformers

.1 Provide CSA approved transformers for each digital controller. Common servicing from transformers is not acceptable.

2.36 Flow Switches (General)

.1 General purpose, CSA approved, paddle type.

.2 SPDT, snap action of spring.

.3 Paddle size: sized to match flow.

.4 Acceptable material: ITT McDonnell & Miller FS4-3.

2.37 Gas Monitoring Panels

.1 NEMA 12 cabinet.

.2 Dual alarm trip points set for 20% and 50% LEL respecitvely.

.3 Time delay on Tun-On to prevent false alarms during warm-up.

.4 Dual DPDT 10A relays for remote alarm and device control.

.5 LED lamps indicating the following:
.1 Power on.
.2 Low alarm.
.3 High alarm.
.4 Fail.

.6 High alarm audic indicator with silence button.

.7 Single button activated test sequence.

.8 All alrms with dead bad that requires gas levels to decline slightly below original trip point before alarms automatically reset.

.9 Number of channels: 6

2.37 Gas Monitoring Panels (Cont'd)

.10 Approvals: CSA certified.

.11 Warranties: 2 year for defects in materials and workmanship.

.12 System description: Dual gas monitoring panels are to be installed in parallel. All alarm conditions to be indicated at both panels. Remote contacts to be installed in parallel from both panels for fan start and remote alarm identification.

.13 Acceptable material: Armstrong Monitoring Corporation Model #1022-M6

2.38 Gas Monitoring Sensors

.1 Signal: 4-20mA linear output correspoding to 0-100% LEL.

.2 Classification: Class 1, Group C/D explosion proof enclosure.

.3 Sensor type: Catalytic pellistor.

.4 Remote calibration with non-interactive zeor and span.

.5 Internal polarity reversal and overvoltage protection.

.6 Approvals: CSA certified.

.7 Warranties: 2 year for defects in materials and workmanship.

.8 Acceptable material: Armstrong Monitoring Corporation Model #3603 sensor transmitter.

2.39 Screen Spray Wash Fill Valve

.1 24V, normally closed solenoid valve.

.2 Bronze body.

.3 CSA approved.

2.40 Hydronic Heat Trace Controllers

.1 Electronic, remote , spdt, two temperature inputs, staged on/off control with 2 relay output stages, range -40degC to 104degC.
.1 Standard of Acceptance: Honeywell T775B controller with remote bulb sensors.

PART 3 - EXECUTION

3.1 Installation

.1 Install all systems and hardware in accordance with the requirements of this specification, good controls practice and the requirements of Division 16.

.2 Install all equipment, components so that manufacturer's and DIN labels are visible and legible after commissioning is complete.

.3 Follow building lines.

.4 Run all systems exposed and do not pass thru or touch un-heated ducts or enclosures.

.5 Locate thermostat sensors 1500 mm above floor as indicated. When conflict occurs follow Engineer's instructions.

.6 All exposed wiring to be in conduit. Wiring,conduit connections and fittings to be as per the requirements of Division 16.

.7 Wiring of line voltage mechanical equipment as per Division 16.

3.2 System Architecture

.1 Control system is to be a combination stand alone digital based control system with local electromechanical and microprocessor controls.

.2 System architecture:.
.1 Ventilation control: programmable PLC on peer-peer network.

3.2 System Architecture (Cont'd)

.2 System architecture: (Cont'd)
.2 HW control: programmable PLC on peer-peer network.
.3 DW control: local electromechanical.
.4 FO control: local electromechanical.
.5 EF control: local electromechanical.
.6 Modem: on peer-peer network for remote communication with PLC's.

3.3 Electrical General

.1 Complete installation in accordance with requirements of:
.1 Division 16, this specification.
.2 CEC.
.3 ANSI/NFPA 70-1996SB.
.4 ANSI C2-1997.

.2 Fully enclose or properly guard electrical wiring, terminal blocks, all high voltage above 70 V contacts and mark to prevent accidental injury.

.3 Conform to all manufacturer's recommendations for storage, handling and installation.

.4 Check all factory connections and joints. Tighten where necessary to ensure continuity.

.5 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.6 Shield and mark all live parts "LIVE 120 VOLTS" or other appropriate voltage.

.7 Holes through exterior wall and roofs: flash and make weatherproof.

.8 All PLC to be connected to dedicated surge and transient protected power supply. Reference Division 16.

3.4 Special Supports

.1 Provide all special steelwork as required for

3.5 Start-Up

.1 Provide representative to assist in Building Start Up as specified in buiding construction specifciations. Representative is to be on site when Start Up testing is performed and witnessed.

.2 Adjust equipment to suit balancing of systems.

3.6 Initial Start Up and Pre Testing Report

.1 One week prior to system Testing contractor is to start up all control systems and provide written report detailing results of initial start up. Report is to detail any outstanding deficiencies,operating difficulties and how these items affect the present building operations.

3.7 Testing-General

.1 Testing to include:

all systems.

.2 Perform work under direction of, and in presence of, Owner or their representative where indicated.

.3 Provide all test equipment, two-way radios.

.4 Inform, and obtain approval from Owner in writing at least 14 days prior to tests. Indicate:
.1 Testing procedures, anticipated results.
.2 Names of testing personnel.

.5 Co-ordinate with all other trades.

.6 Correct deficiencies, re-test in presence of Owner until satisfactory performance is obtained.

General (Cont'd)

.7 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

3.8 Acceptance Tests

.1 Upon completion of installation perform operational test of entire system under supervision of Engineer.

.2 Provide:
.1 At least one technical personnel capable of adjusting field hardware and devices.

.3 Purpose: to demonstrate that control system functions in accordance with all contract requirements.

.4 Test to last at least 2 consecutive 24 hour days per building.

.5 Tests to include:
.1 Demonstration of correct operation of all controlled devices.
.2 Demonstration of operation of all sequences and alarms as per design control logic.
.3 Testing and calibration all devices.
.4 Testing and calibration of each controller using calibrated instruments.
.5 PLC Validation as follows:
.1 Demonstrate DC loop precision and stability of inputs and outputs.
.2 Execute all digital and analog commands.
.3 Display and operate all data input/output functions.
.4 Prove operation of remote dial up communications. Provide two dial up weekly trend reports minimum one week apart. Use construction telephone lines for validation.

.6 System is accepted if:
.1 Control system and devices operate as per intent of specifications and drawings to the satisfaction of the Owner.

.7 Correct all defects when they occur and before resuming test.

3.9 Training Materials	.1	Provide all equipment, visual and audio aids, and materials for classroom training.
3.10 Training Program	.1	Phase 1: for 3 days before building completion at a time mutually agreeable to the Engineer and the Owner. Train O& M personnel in functional operations and procedures to be employed for system operation. Supplement with continuous on-the-job training during test, commisioning period. To include overview of system architecture, communications, operation of computer and peripherals, report generation; detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
	.2	Phase 2: 1 year after project completion provide for 2 days additional training. For operators and equipment maintenance personnel. Provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.
	.3	Provide training program for each building.
3.11 Monitoring of Training	.1	Engineer will monitor training program and retains right to modify schedule and content.
	.2	Maintain attendance log of all training signed by attendees. Furnish to Engineer upon request.
3.12 Warranty Testing and Adjustment	.1	Provide for site testing and adjustment one year after completion of project.
	.2	Provide for each building.

3.13 Panels

.1 Install panels to requirements of CEC in locations as indicated.

3.14 Auto dialer

.1 Auto dialer provided in process control panel. See Div 16.

.2 Single channel on auto dialer dedicated to mechanical alarms.

3.15 Gas Monitoring System

.1 Gas monitoring system to act as 6 channel two monitor system.

.2 Mount single monitor at each man door to STP. Total two monitors.

.3 Remote controlled devices to be activated from both monitors in parallel.

.4 Operation: on alarm condition at any sensor both monitors to indicate alarm and activate remote control devices.

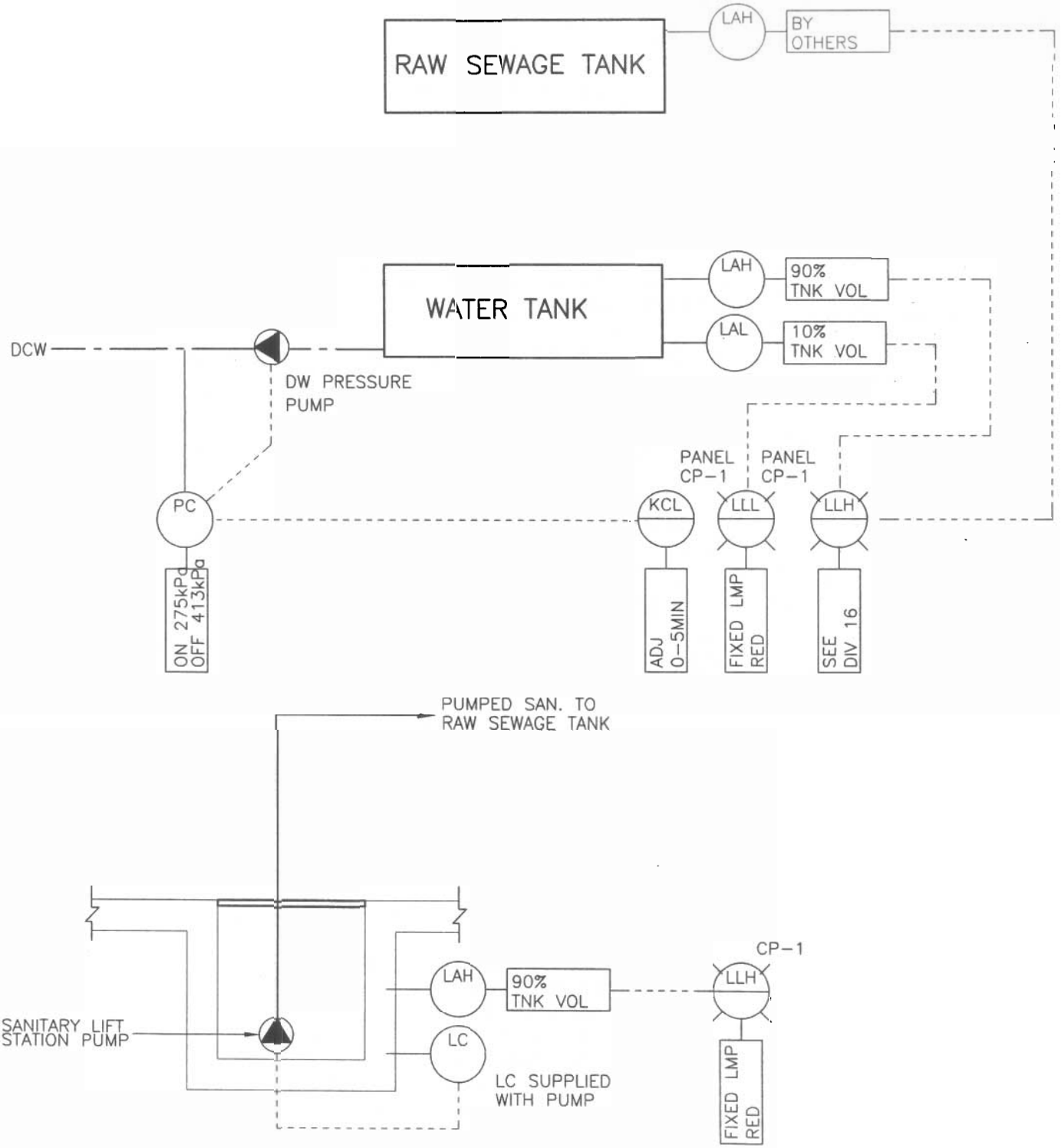
.5 Control devices:
.1 AHU 1 and 2 on low level alarm.
.2 Remote alarm lamps on high level alarm.
Reference Div 16.

3.16 Control System Documentation

.1 Control sequences and drawings attached and on mechanical drawings as follows:
.1 Sanitary Systems-2 pages.
.2 Fuel Oil System-3 pages.
.3 Non Potable Water Screen Spray Wash-2 pages.
.4 Heating Water-3 pages.
.5 UH and Bldg Trouble-3 pages.
.6 Ventilation AHU 1-5 pages.
.7 Emergency Ventilation-4 pages.
.8 Generator Room Cooling-3 pages.
.9 Heat Trace Controls-4 pages.
.9 CP-1 Mechanical Room Panel-1 page.
.10 CP-2 AHU 1 Panel-1 page.
.11 CP-3 AHU 2 Panel-1 page.

END

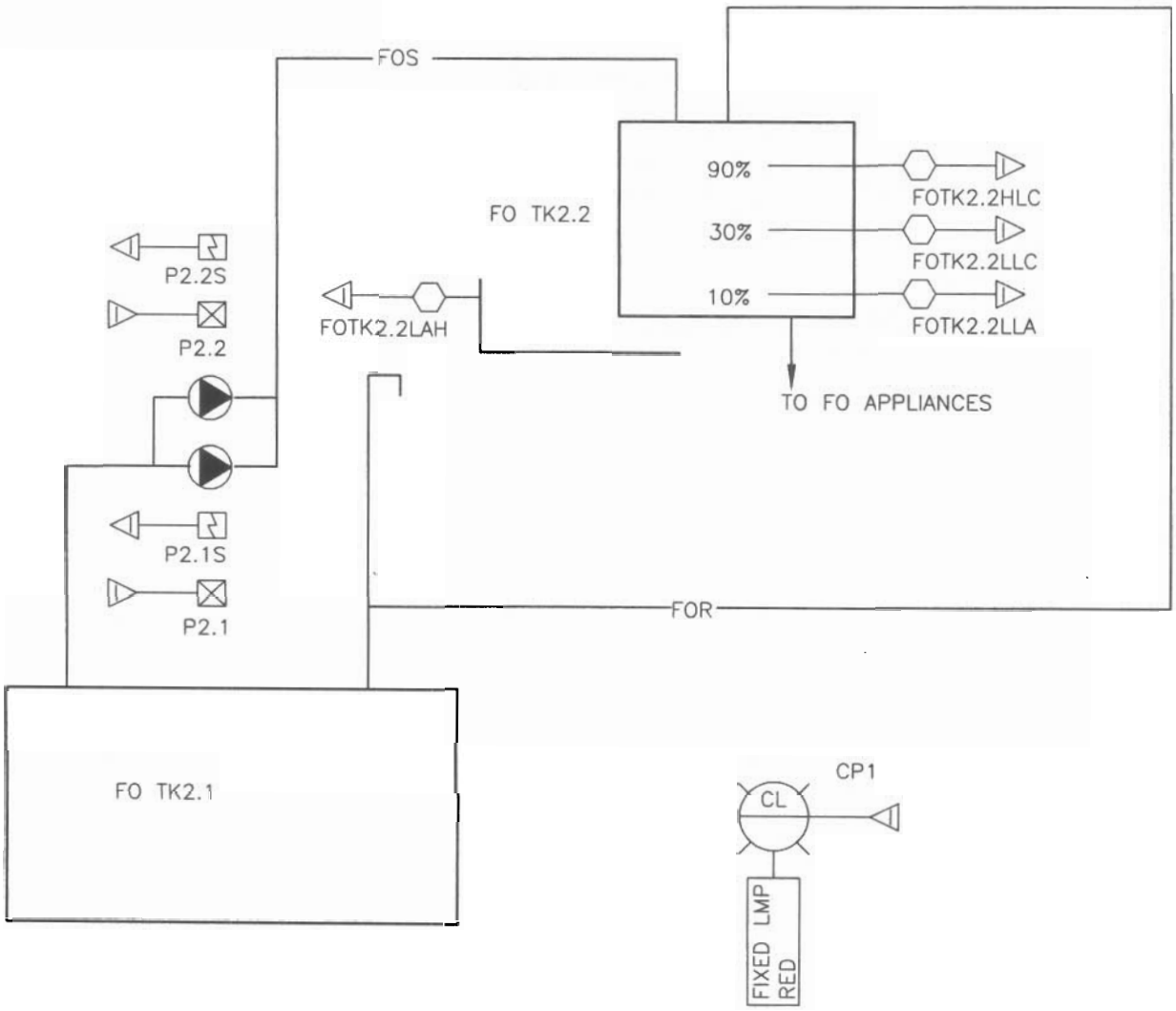
SYSTEM TAG: SANITARY SYSTEMS



System Tag: Sanitary System

Ref	Description		Comments
1.1	DW Pump to operate on hardwired pressure controller. Pump on at 275kPa off at 413kPa.		
1.2	At high level sanitary tank level DW Pump locked out. See item 1.5 for reset.		High level sewage alarm by others
1.3	At 10% water tank level DW Pump locked out. Alarm low water. See item 1.5 for reset.		CP 1: Fixed red lamp Exterior lamp: See Div 16.
1.4	At 90% water tank level indicate full tank at exterior lamp.		Exterior lamp: See Div 16.
1.5	DW pump auto reset on time delay KCL after alarm conditions corrected. Initial set point 2min.		
1.6	Sump pump to cycle on level switch.		
1.7	At high sump level alarm.		CP 1: Fixed red lamp.

SYSTEM TAG: FO SYSTEM



SYSTEM TAG: FO System

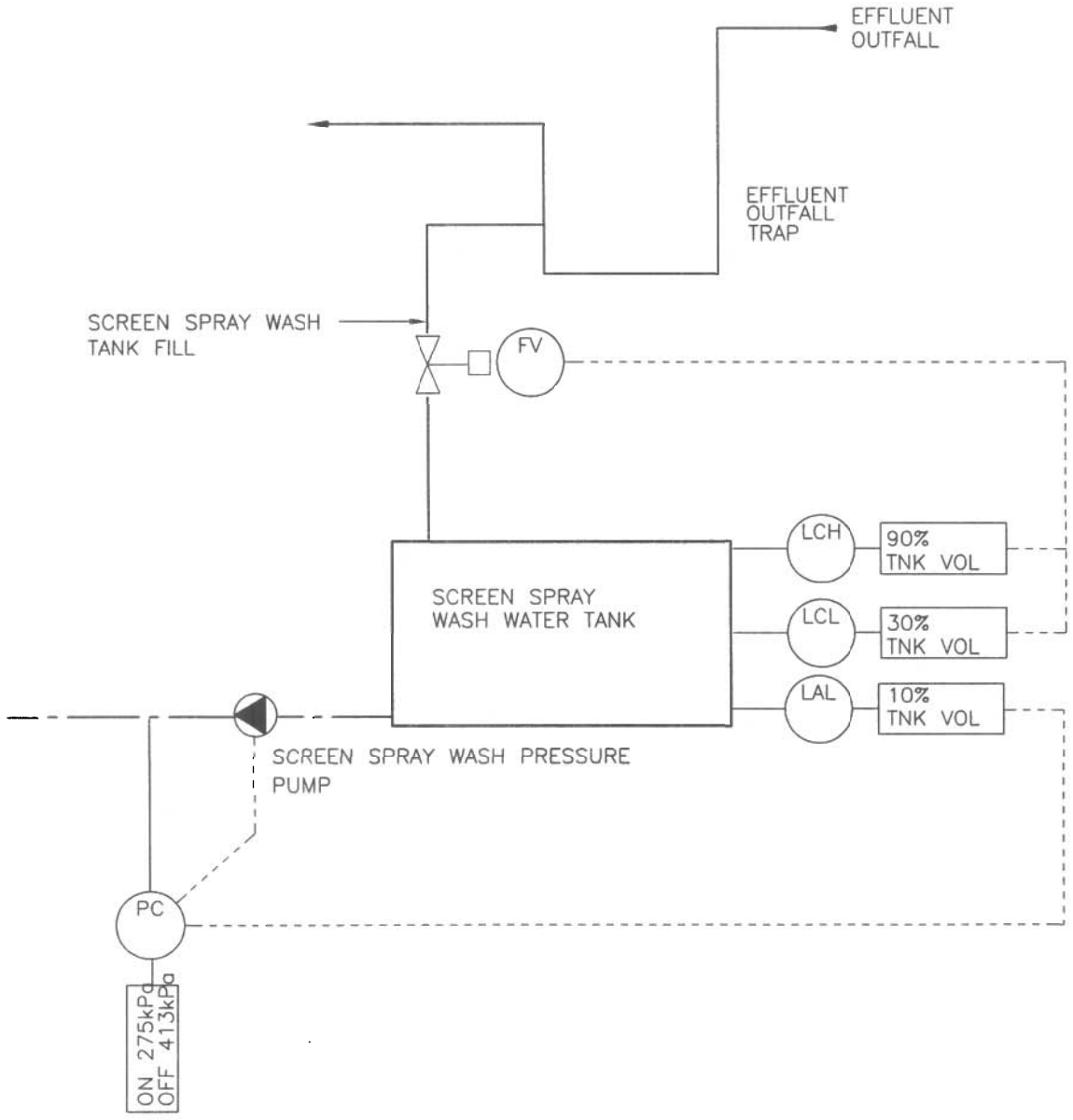
Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
P2.1S	P2.1 status	IR	X				TBD		W		X			
P2.1	P2.1 control	CR		X										X
P2.2S	P2.2 status	CR	X				TBD		w		X			
P2.2	P2.2 control	IR		X										X
FOTK2.2HLC	FO Tank2.2 high level control	LS	X				75%							
FOTK2.2LLC	FO Tank2.2 low level control	LS	X				30%							
FOTK2.2LLA	FO Tank2.2 low level alarm	LS	X				10%							
FOTK2.2LAH	FO Tank2.2 leak alarm	LS	X						C					

Notes:	PCU Device
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PCU 1 Location: CP 1 Additional Pt Tags:

System Tag: FO System

Ref	Description		Comments
1.1	FO Pump to operate lead/standby. Pumps to alternate on total run time duty cycle. Alternate main pump after 20hrs operation. Indicated transfer.		
1.2	FO Pump status by P2.1S/P2.2S. In event of lead pump failure auto-change to standby pump and indicate failure.		
1.3	In event of lead pump and standby pump failure indicate failure. Signal auto dialer.		CP1: Fixed red lamp (Fuel System Failure) Auto dialer: See Div 16
1.4	Lead FO pump to cycle to maintain TK 2.2 FO levels. Pump on at FOTK2.2LLC and off at FOTK2.2HLC.		
1.5	Indicate low FO alarm for FO TK2.2 at FOTK2.2LLA. Alarm and signal auto dialer.		CP1: Fixed red lamp (Fuel System Failure) Auto dialer: Ref Div 16.
1.6	FOTK2.2LAH to indicate FO in TK2.2 dike. In event of FO in dike FO pumps locked out. Signal auto dialer.		CP1: Fixed red lamp (Fuel System Failure) Auto dialer: Ref Div 16.

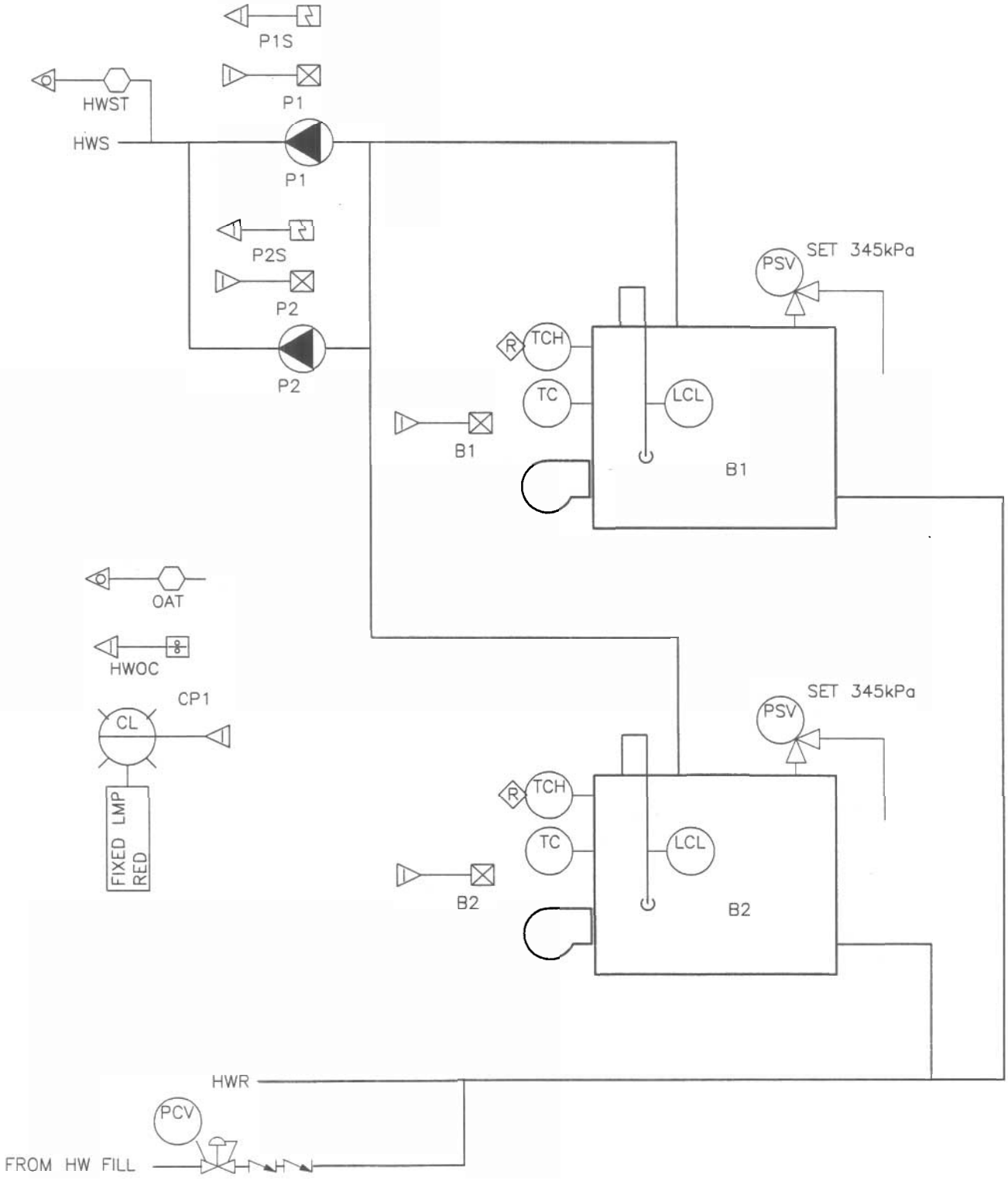
SYSTEM TAG: NON-POTABLE WATER SCREEN SPRAY WASH



System Tag: Non Potable Screen Spray Wash

Ref	Description		Comments
1.1	Pressure pump to operate on hardwired pressure controller. Pump on at 275kPa off at 413kPa.		
1.2	At 10% water tank level DW Pump locked out. Alarm low water. See item 1.5 for reset.		
1.3	Tank fill from outfall line. At 30% tank level solenoid valve open. At 90% tank level vlave closed.		

SYSTEM TAG: HEATING WATER



SYSTEM TAG: HW System

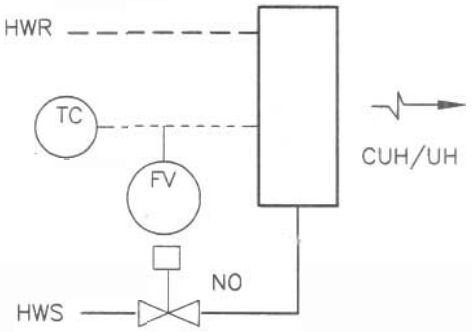
Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
P1S	P1 status	IR	X				TBD		C					
P1	P1 control	CR		X										X
P2S	P2 status	CR	X				TBD		C					
P2	P2 control	IR		X										X
HWST	HWS temperature	TTW			X		0-125	degC	C					
B1	Boiler B1 controller	CR		X			TBD							
B2	Boiler B2 controller	CR		X			TBD							
OAT	HW System O/A temperature	TTA			X		(-)55-50	degC						
CL-RED	Red alarm lamp	CR		X										
HWOC	Night set back	CR		X										

Notes:	PCU Device
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PCU 1 Location: CP1 Additional Pt Tags:

System Tag: HW System

Ref	Description		Comments
1.1	HWST temp less than 50degC for >60min when HW pumps enabled signal alarm, auto dialer and strobe.		CP1: Fixed red lamp(Heating System Failure) Auto dialer: See Div 16 Exterior strobe: See Div 16
1.2	HW Pumps to operate lead/standby. Pumps to alternate on total run time duty cycle. Alternate lead pump after 168 hrs operation.		
1.3	Main HW Pump on two-position on/off switch. Provide minimum 30minutes run time.		
1.4	When HW pump flow proved by pump status P1S or P2S enable boiler temperature controllers to cycle burners. Burner to cycle to maintain controller set point.		
1.5	HW Pump P1/2 status by P1S/P2S. In event of pump failure auto-change to standby pump and signal alarm.		CP 1: Fixed red lamp (Heating System Failure)
1.6	TCH to provide boiler high limit protection. In event of high limit set point burner disabled. Manual reset.		
1.7	LWCO to provide boiler low water protection. In event of low water level burner disabled. Manual reset.		
1.8	In event of panel failure HW pumps on and boilers enabled. In event of power failure heating system to restart without reset of any devices.		

SYSTEM TAG: UH



SYSTEM TAG: BLDG TROUBLE

LOCATED STP

FLRTEMP

FLRHUMID

SYSTEM TAG: Misc/Bldg Trouble

Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
FLRTEMP	Main floor low temp alarm	TTA			X		5-30	degC						
FLRHUMID	Crawlspace low temp alarm	TTA			X		5-30	degC						
AUTODIAL	Auto dialer	CR		X										

Notes:	PCU Device:
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PCU 1 Location: CP-1 Associated controls: N/A

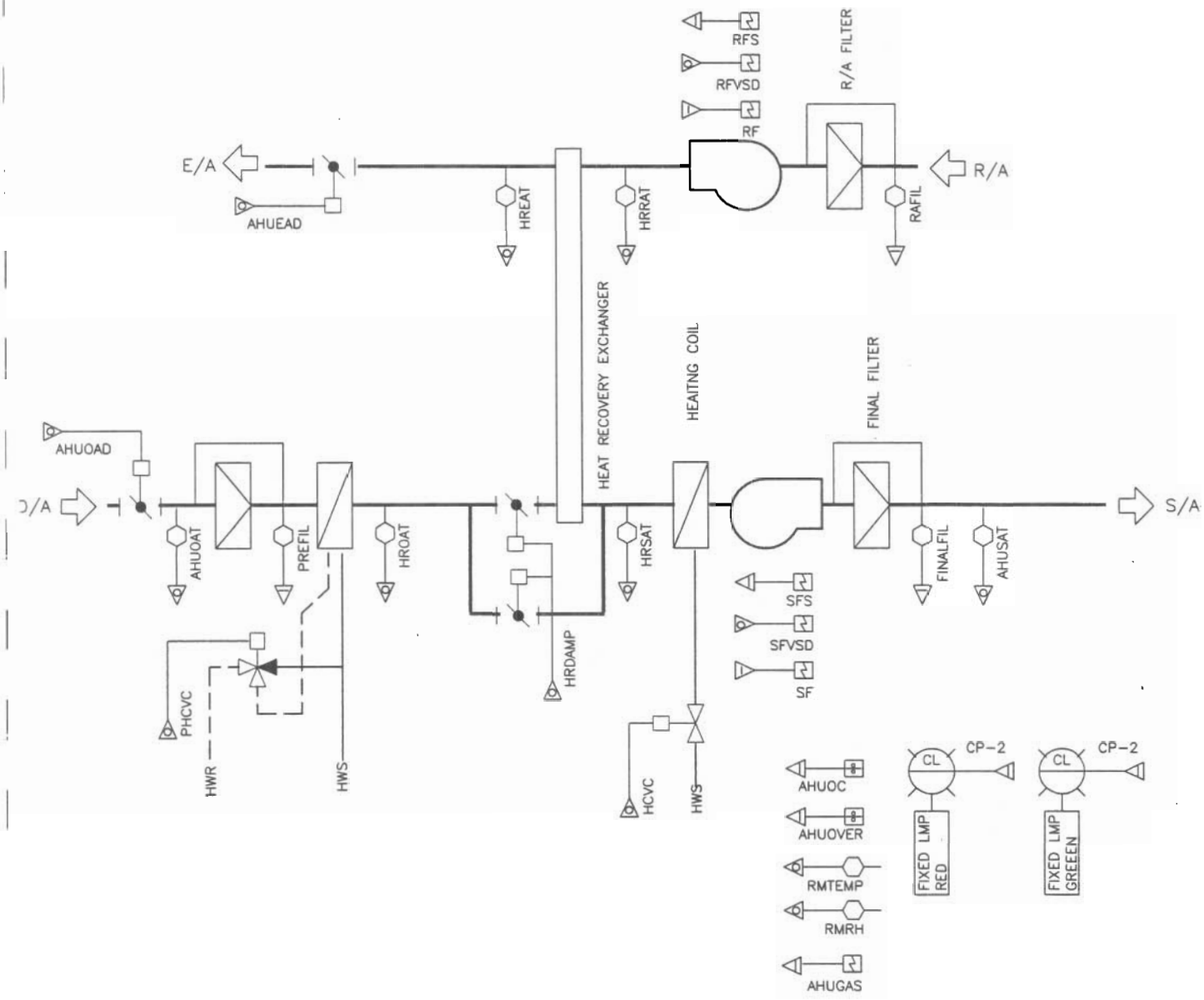
System Tag: Bldg Trouble

Ref	Description		Comments
1.1	When space temp at FLRTEMP below 5degC signal auto dialer and exterior strobe.		Auto dialer: See Div 16. Strobe: See Div 16.
1.2	When space humidity at FLRHUMID above 80%RH signal auto dialer and exterior strobe.		Auto dialer: See Div 16. Strobe: See Div 16.

System Tag: UH

Ref	Description		Comments
1.1	TC to cycle UH fan motor and open HWS valve FV full open to satisfy set point.		

SYSTEM TAG: VENTILATION



SYSTEM TAG: Ventilation-AHU 1

Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
SFS	S/A fan status	IR	X				TBD							
SFVSD	S/A fan variable speed drive	VFD				X								
RFS	R/A fan status	IR	X				TBD							
RFVSD	E/A fan variable speed drive	VFD				X								
SF	SF start/stop	CR		X										X
RF	RF start/stop	CR		X										X
HRDAMP	Heat recovery bypass damper control	CV				X				X				
AHUOAD	AHU outdoor air damper control	CV				X				X				
AHUEAD	AHU exhaust/return air damper control	CV				X				X				
AHUSAT	Discharge air temperature	TT RTD			X		-10-25 Reset	degC						
AHUOAT	Outdoor air temperature	TT RTD			X		-55-50 Reset	degC						
RAFIL	Return air filter pressure drop	trans	X				0-500	Pa						
PREFIL	Pre filter pressure drop	trans	X				0-500	Pa						
FINALFIL	Final filter pressure drop	trans	X				0-500	Pa						

Notes:	PCU Device:
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PLC 2 Location: Panel CP-2 Associated controls: N/A

SYSTEM TAG: Ventilation-AHU 1

Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
HRRAT	Heat recovery return air temperature	TT RTD			X		0-50	degC						
HREAT	Heat recovery exhaust air temperature	TT Therm			X		-55-50	degC						
HRSAT	Heat recovery supply air temperature	TT RTD			X		0-50	degC						
HROAT	Heat recovery outdoor air temperature	TT Therm			X		-55-50	degC						
PHCVC	Pre heat coil control valve	CV				X				X				
HCVC	HC control valve	CV				X				X				
AHUOC	AHU on/off/auto	CR	X											
AHUOver	AHU high/low selector	CR	X											
CL	Control lamp, AHU Fail	CR		X										
CL	Control lamp-AHU on	CR		X										
RMTEMP	STP space temperature	TT Therm			X		0-50	degC						
RMRH	STP humidity	MT			X		0-100%	RH						
AHUGAS	First stage gas detector alarm	CR	X											

Notes:	PCU Device:
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PLC 2 Location: CP 2 Associated controls:

System Tag: AHU 1

Ref	Description		Comments
1.	**Unit Control and Fail**		
1.1	Unit OFF or FAIL: outdoor, exhaust and HRC bypass dampers full closed, PHCVC under control, HCVC not heat, fans off.		
1.2	Start/stop control by three-position switch at CP2 thru AHUOC input. ON: manual start. AUTO: unit start/stop on space demand. OFF: unit manually off and auto start disabled.		CP-2: Three position switch on/off/auto.
1.3	Two position switch to select between normal and high ventilation rates thru AHUOVER signal when unit start switch in ON position.		
1.4	When unit on indicate unit on at CP-2.		CP-2: fixed green lamp.
1.5	FAIL: Unit off by equipment or operating failure.. Unit locked out until alarms cleared. Alarm fail condition CP-2.		CP-2: fixed red lamp.
2.	**Fan Alarms**		
2.1	SF and RF status by SFS and RFS. On failure unit to FAIL. Manual reset at O/I.		
3	**Unit low temperature alarms**		
3.1	Discharge air temp AHUSAT 5degC<reset air set point for>5minutes modulate bypass damper to full open until alarm cleared or when alarm >15min unit to FAIL. Manual reset at O/I.		
3.2	Discharge air temp AHUSAT 5degC<reset air set point for >15minutes or AHUSAT< 0degC for >5 minutes alarm and unit to FAIL. Manual reset at PLC.		
3.3	At high AHU2GAS detection low temperature alarms disabled.		
4	**Filter Alarms**		
4.1	If PREFIL, FINALFIL or RAFIL > HIGH SETPT alarm and unit to FAIL. HIGH SET POINT to be field determined. Manual reset at O/I.		
4.2	At high AHU2GAS detection filter alarms disabled.		

5 Ventilation

5.1 When AUTO selected at CP2 unit to start in normal speed when RMTEMP greater than 23degC or RMRH greater than 30%RH. Unit to high speed when RMTEMP above 28degC or RMRH above 40% RH. Set points to be adjustable at O/I. Minimum run time on unit start 30min.

5.2 On AHUGAS detection unit to high speed. Minimum runtime 30min.

5.3 On start AHUOAD and AHUEAD to full open position. HRDAMP full closed.

5.4 SF starts and ramps to normal or high speed set point on VFD. RF to start 15sec after RF and ramps to normal or high speed set point. PHCVC, HCVC and HRDAMP under control.

5.5 Modulate PHCVC to maintain HROAT at minimum –16degC.

5.6 Proportionally open HRDAMP to maintain heat recovery coil discharge air temperature HRSAT at RESET SAT and HREAT at a minimum 1degC.

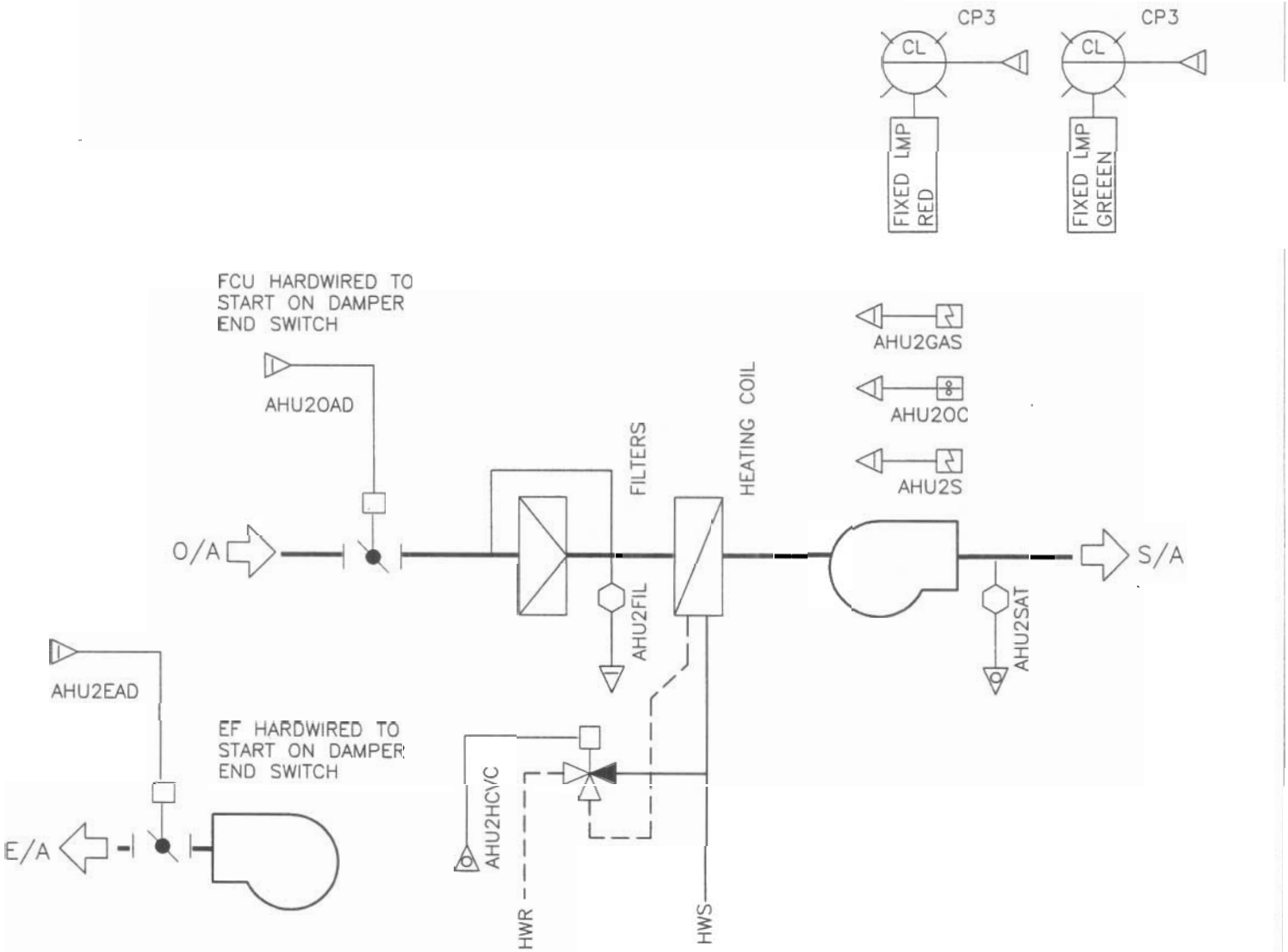
5.7 Modulate HCVC to maintain RESET SAT

5.8 RESET SAT based on OAT as follows:

OAT	SAT
-30degC	20degC
0degC	13degC

Reset ratio and set points to be adjustable at IID.

SYSTEM TAG: EMERGENCY VENTILATION



SYSTEM TAG: Emergency Ventilation-AHU 2

Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
AHU2S	AHU2 S/A fan status	IR	X				TBD							
AHU2OAD	AHU outdoor air damper control	CV				X				X				
AHU2FIL	AHU2 Filter pressure drop	trans	X				0-500	Pa						
AHU2SAT	AHU2 Supply air temperature	TT RTD			X		0-50	degC						
AHU2HCVC	AHU2 HC control valve	CV				X				X				
AHU2OC	AHU2 on/off/auto	CR	X											
AHU2GAS	AHU2 Gas detector start relay	CR	X											
CL	Control lamp, AHU2 Fail	CR		X										
CL	Control lamp-AHU2 on	CR		X										

Notes:	PCU Device:
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PLC 3 Location: CP 3 Associated controls:

System Tag: AHU 2 Emergency Ventilation

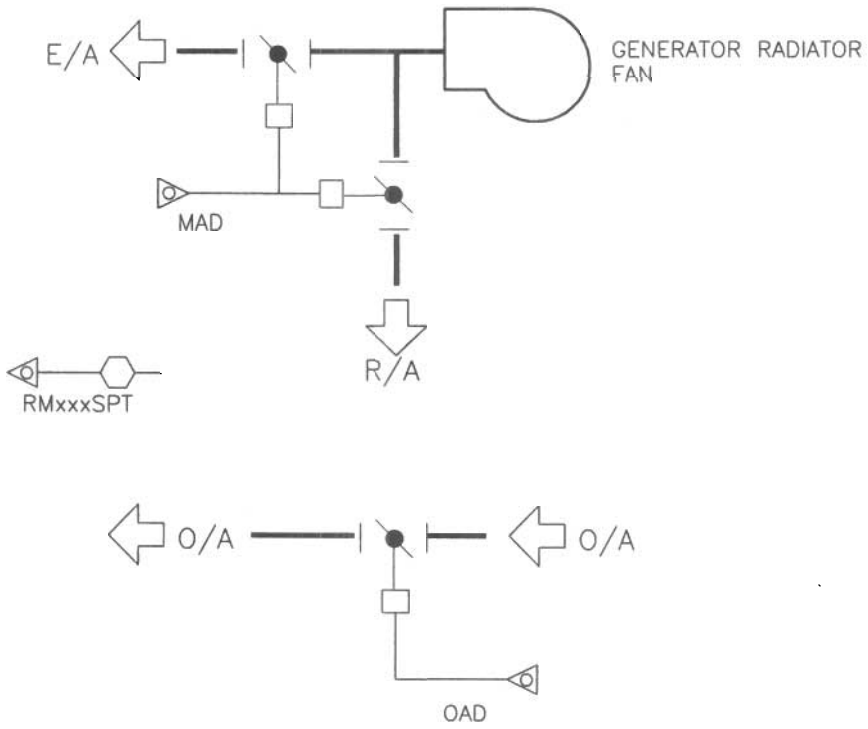
Ref	Description		Comments
1.	**Unit Control and Fail**		
1.1	Unit OFF or FAIL: outdoor and exhaust dampers 100% closed, AHU2HCVC under control, EF and EF fan off.		
1.2	Panel CP-3: Start/stop control by three-position switch thru AHUOC input. ON: manual start. AUTO: unit on by gas detection AHU2GAS until alarm cleared or minimum run time compelted. OFF: unit manually off, all overrides and auto start disabled. Minimum run time 30min.		CP-3: Three position switch on/off/auto.
1.3	When unit on indicated unit on at CP-3.		CP-3: fixed green lamp.
1.4	FAIL: Unit off by equipment or operating failure.. Unit locked out until alarms cleared. Alarm fail condition CP-3.		CP-3: fixed red lamp.
2.	**Fan Alarms**		
2.1	SF status by AHU2S. On failure unit to FAIL. Manual reset at O/I.		
3	**Unit low temperature alarms**		
3.1	Discharge air temp AHU2SAT 5degC<AHU2SAT for>5minutes indicate alarm.		
3.2	Discharge air temp AHU2SAT 5degC<AHU2SAT >15minutes or AHU2SAT< 0degC for >5 minutes alarm and unit to FAIL. Manual reset at O/I.		
3.3	At high AHU2GAS detection low temperature alarms disabled.		
4	**Filter Alarms**		
4.1	If AHU2FIL > HIGH SETPT alarm and unit to FAIL. HIGH SET POINT to be field determined. Manual reset at O/I.		
4.2	At high AHU2GAS detection filter alarms disabled.		

5 Ventilation

5.1 On start AHU2OAD and EF1EAD dampers to full open positions AHU2 SF and EF1 to start on damper end switches.

5.2 Modulate AHU2HCVC to maintain SAT at 18degC.

SYSTEM TAG: GENERATOR RM COOLING



SYSTEM TAG: Generator Rm Cooling

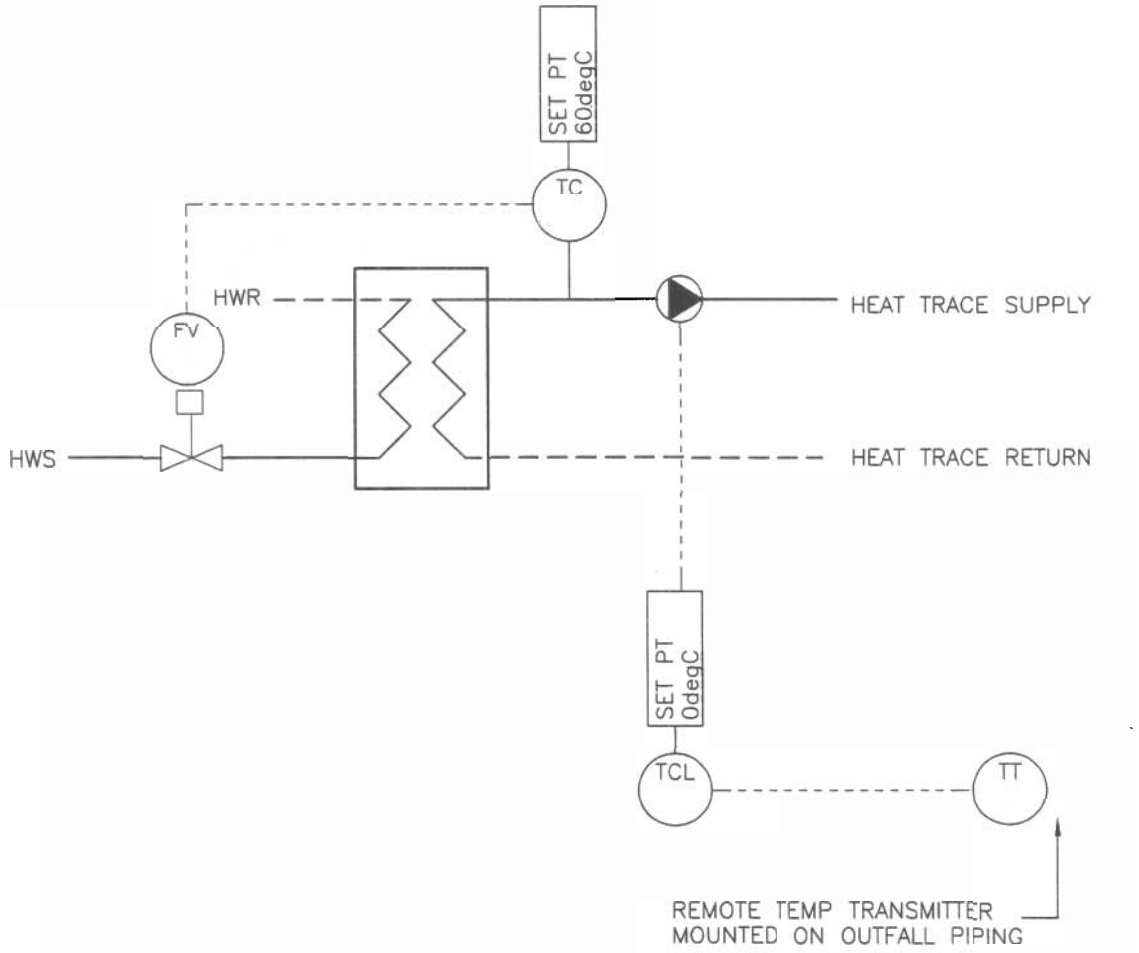
Point Identification		Point Type							Alarm and Control					
Pt Label	Description	Device Type	DI	DO	AI	AO	Range/ Set Pt	Units	Alarm Message	PID Control	Run Time Total	Analog Total	OPT Start/Stop	Auto Start/Stop
MAD	F3.1 mixing damper control	CV				X				X				
RMxxxSPT	Space temperature sensor	TT therm			X		5-50 St Pt: 25	degC						
EAD	F3.1 exhaust damper control	CV				X				X				

Notes:	PCU Device:
Alarms: C = Critical W = Cautionary or warning M = Maintenance	Ref Number: PLC1 Location: CP 1 Associated controls:

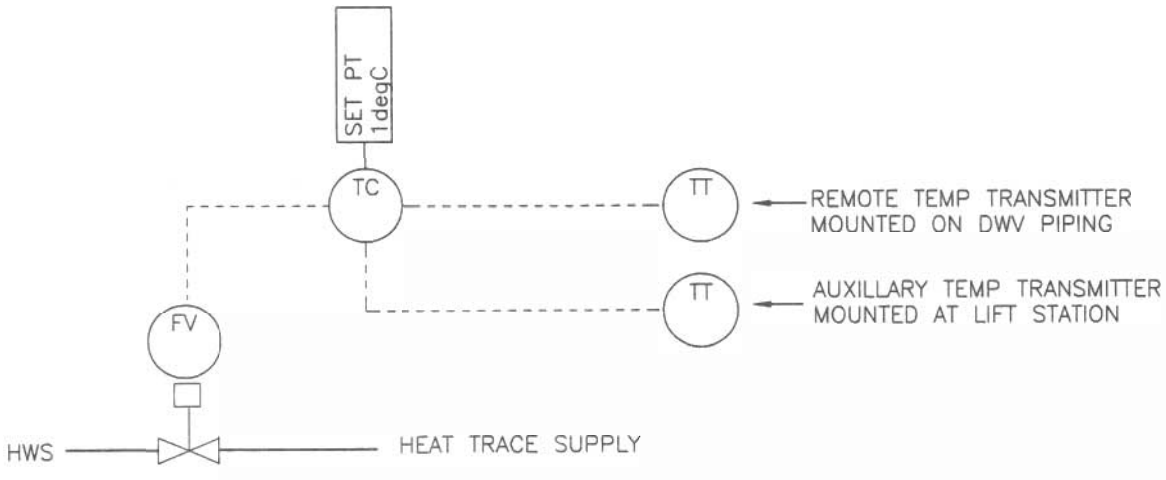
System Tag: Generator Rm Cooling

Ref	Description		Comments
1.1	On generator start OAD to minimum position for combustion air. Modulate MAD and OAD to maintain space temperature at RMxxxSPT.		
1.2	After generator off continue operation of dampers for min run time 10minutes. Control as above except dampers to never open close more than 50%. Run time to be adjustable.		
1.3	When generator off and RMxxxSPT greater than 30degC enable operation of dampers until space temp below 30degC. Control as per operating condition except dampers to never open close more than 50%. Run time to be adjustable.		

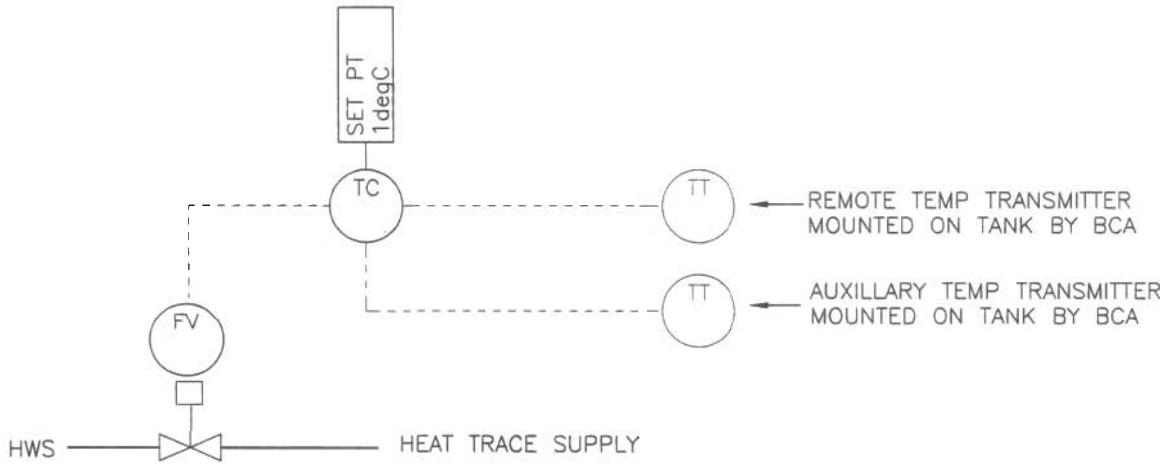
SYSTEM TAG: OUTFALL HEAT TRACE



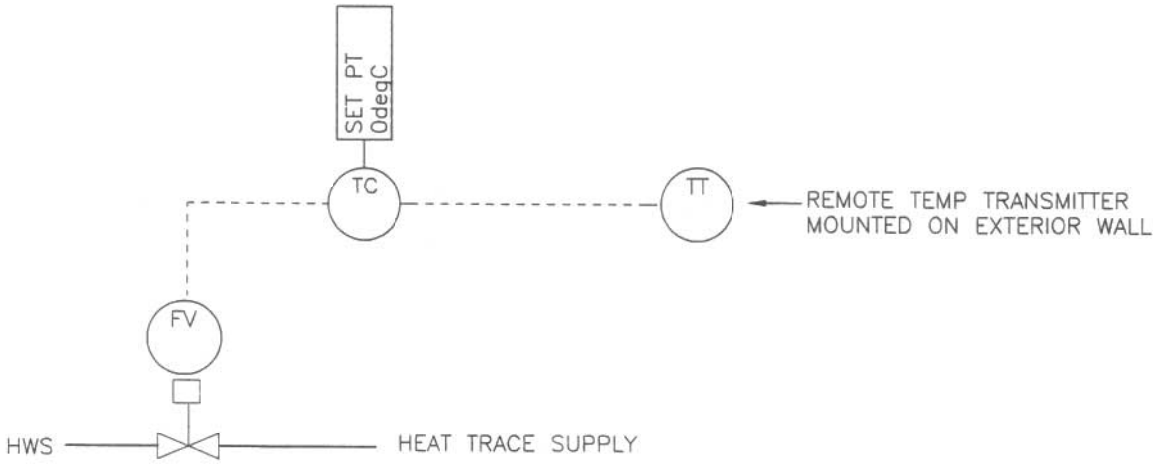
SYSTEM TAG: DWV/LIFT STATION PIPING HEAT TRACE



SYSTEM TAG: RAW/SCREENED SEWAGE TAKNK HEAT TRACE



SYSTEM TAG: EQUALIZATION TANK AND SLUDGE TANK HEAT TRACE



System Tag: Outfall Heat Trace

Ref	Description		Comments
1.1	When outfall piping temperature at 0degC TCL to start heat trace pump.		
1.2	When heat trace pump on modulate HWS to maintain maximum heat trace supply temperature at 60degC.		

System Tag: DWV/Lift Station Heat Trace

Ref	Description		Comments
1.1	When lift station or piping temperature at 1degC open FV to satisfy.		

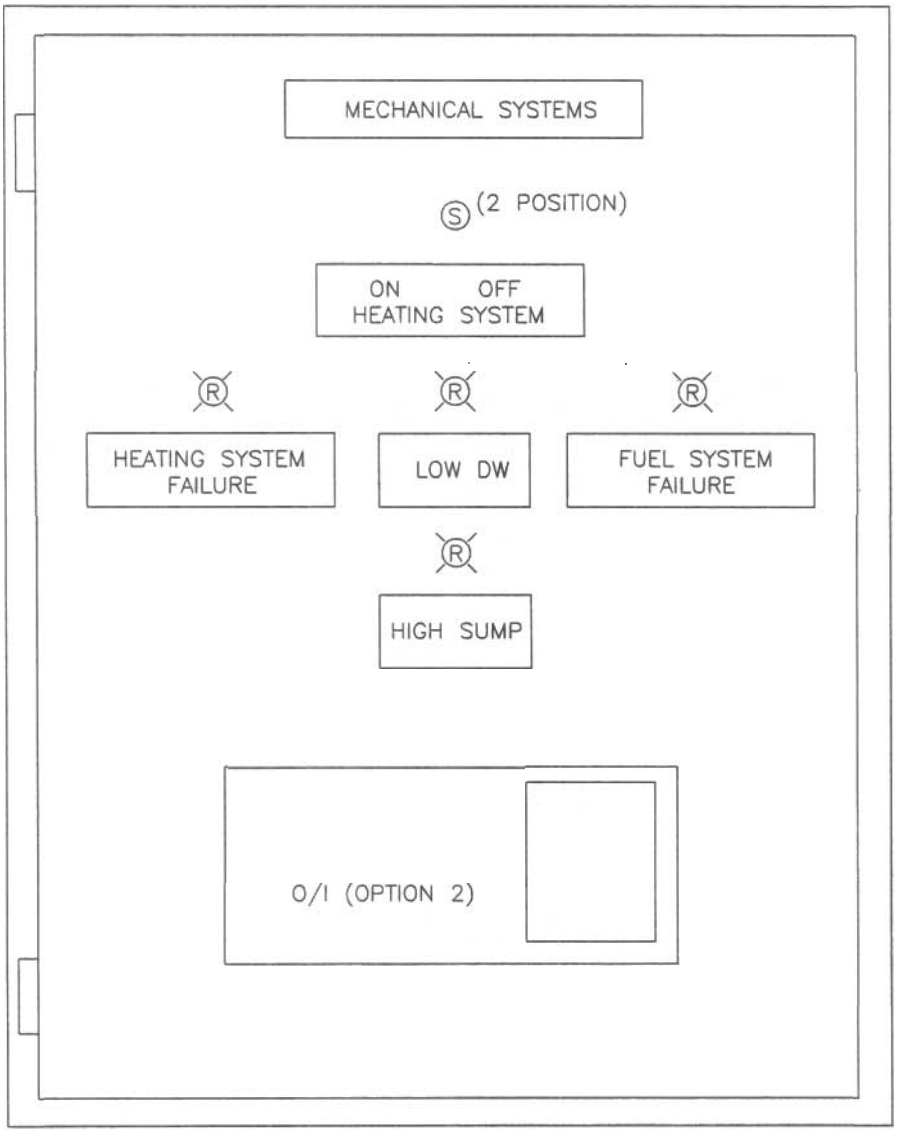
System Tag: Raw and Screened Sewage Tank Heat Trace

Ref	Description		Comments
1.1	When tank temperature at 1degC open FV to satisfy.		
1.2	Spare TT installed by tank manuf for future use as required.		

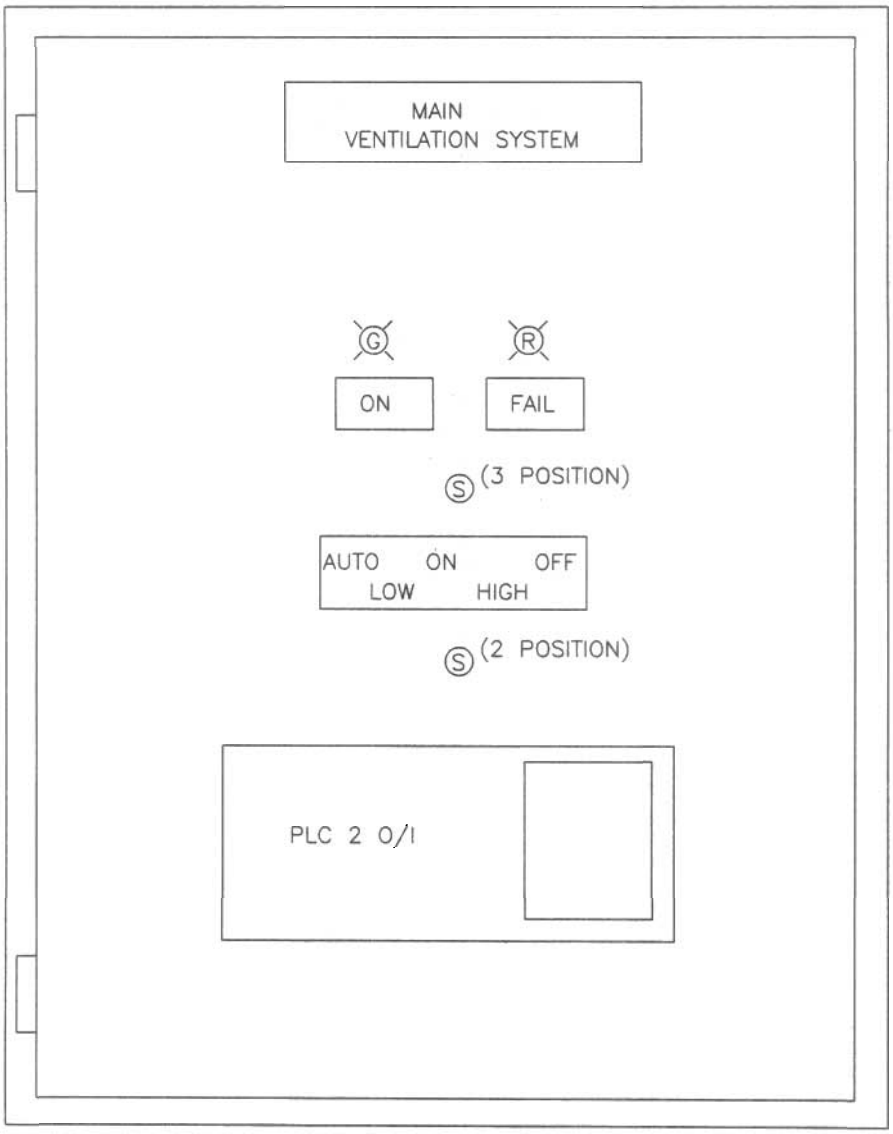
System Tag: Equalization Tank and Sludge Tank Heat Trace

Ref	Description		Comments
1.1	When outdoor air temperature below 0degC open FV.		

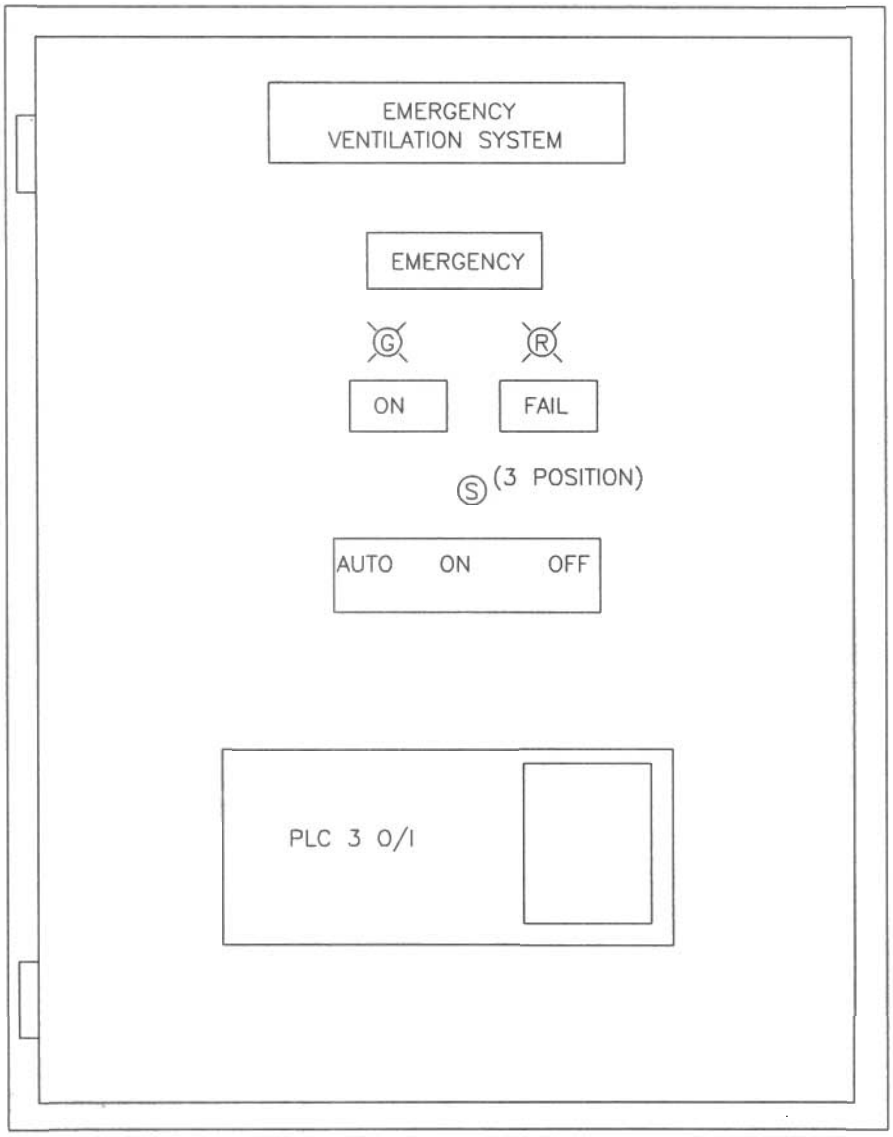
SYSTEM TAG: CP-1 (MECHANICAL ROOM)



SYSTEM TAG: CP-2 (FAN MEZZANINE)



SYSTEM TAG: CP-3 (FAN MEZZANINE)



PART 1 - GENERAL

1.1 Details

.1 Mechanical details and schematics are attached as follows:

- .1 Misc Details
  - .1 Pipe Hanger
  - .2 Mettalic Insulated Pipe Fire Stop
  - .3 Fire Rated PVC 50dia and Smaller Fire Stop
  - .4 Fire Rated PVC 63dia and Larger Fire Stop
  - .5 Generator Thimble
  - .6 Generator Exhaust
  - .7 Generator Flexible Connection Safety Screen
  - .8 Floor Mounted Pipe Cover
- .2 Tankage Details
  - .1 Lift Station
  - .2 Domestic/FW Fill and Vent
- .3 Process Piping Details
  - .1 Piping Concrete Floor Stands
  - .2 Truck Discharge Piping
  - .3 Outfall Piping Connections
  - .4 Magnetic Flow Meter Installation & Trap at Outfall
  - .5 Magnetic Flow Meter Installation at Raw Sewage Tank Pump Discharge
- .4 Heating Details
  - .1 HW Branch Connection
- .5 Ventilation Details
  - .1 Wall Hood
  - .2 Fire Damper-Type 1
  - .3 Fire Damper-Type 2
  - .4 Boiler Chimney-Bottom
  - .5 Boiler Chimney-Top
  - .6 Chimney Radiation Shield

.2 Confirm details are attached and where details are missing obtain copies from Tender registry as required

PART 2 - PRODUCTS

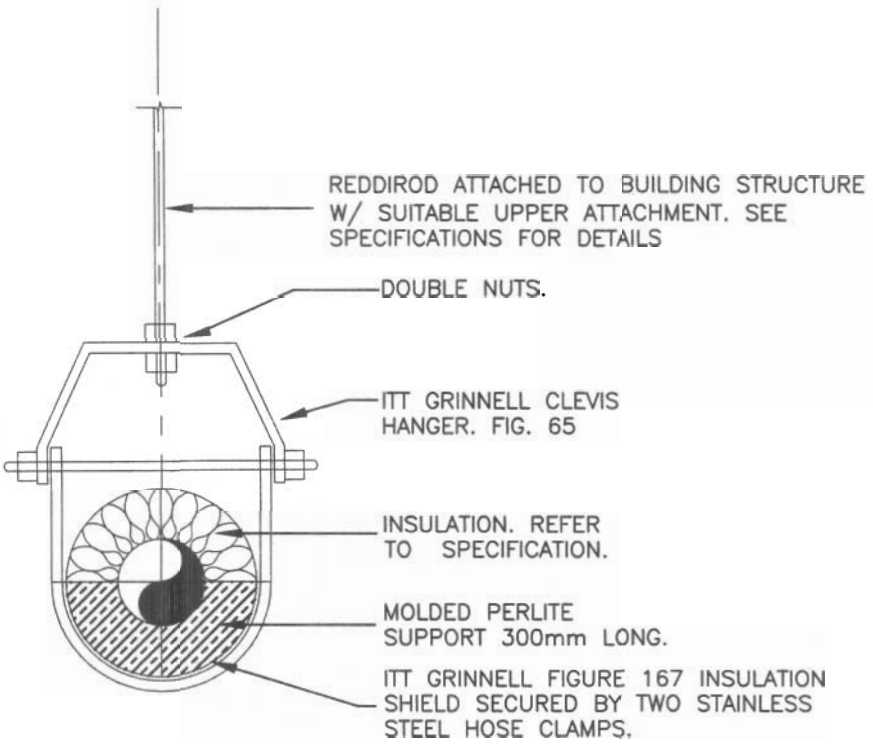
.3 Not Applicable

PART 3 - EXECUTION

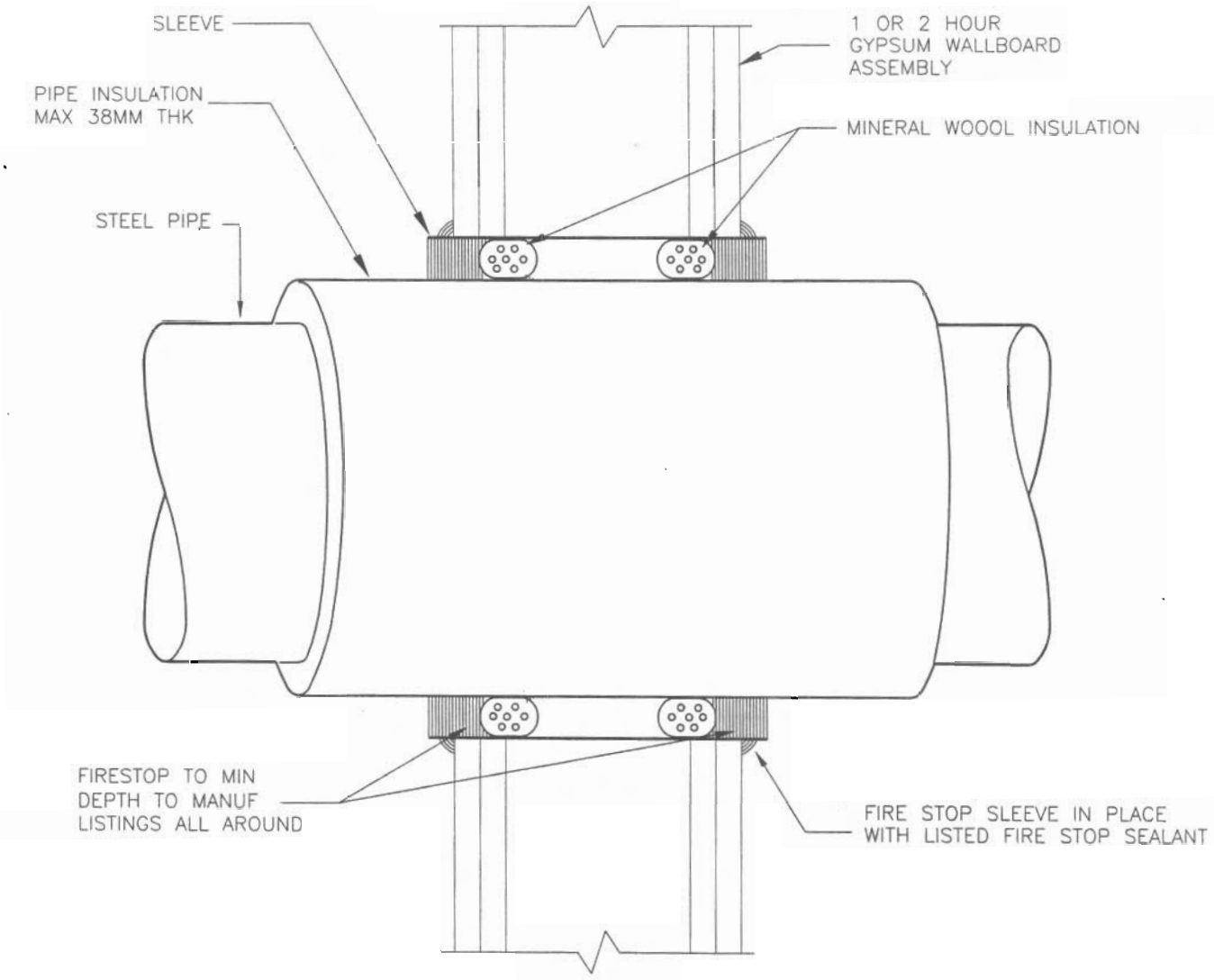
3.1 General .1 Review detail sheets and provide mechanical systems as per details.

END

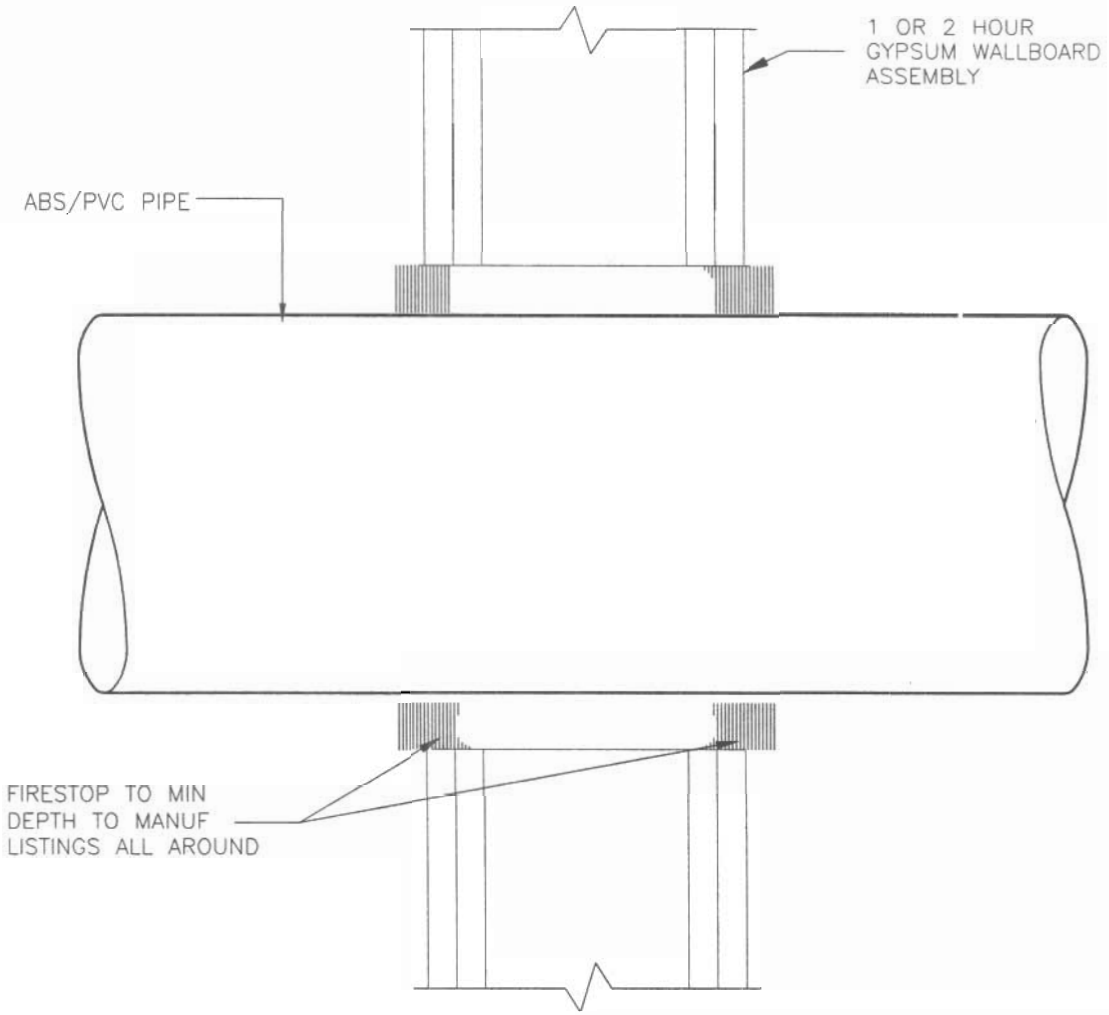
NOTE. THIS DETAIL APPLIES TO ALL HW & RIGID DW PIPING.



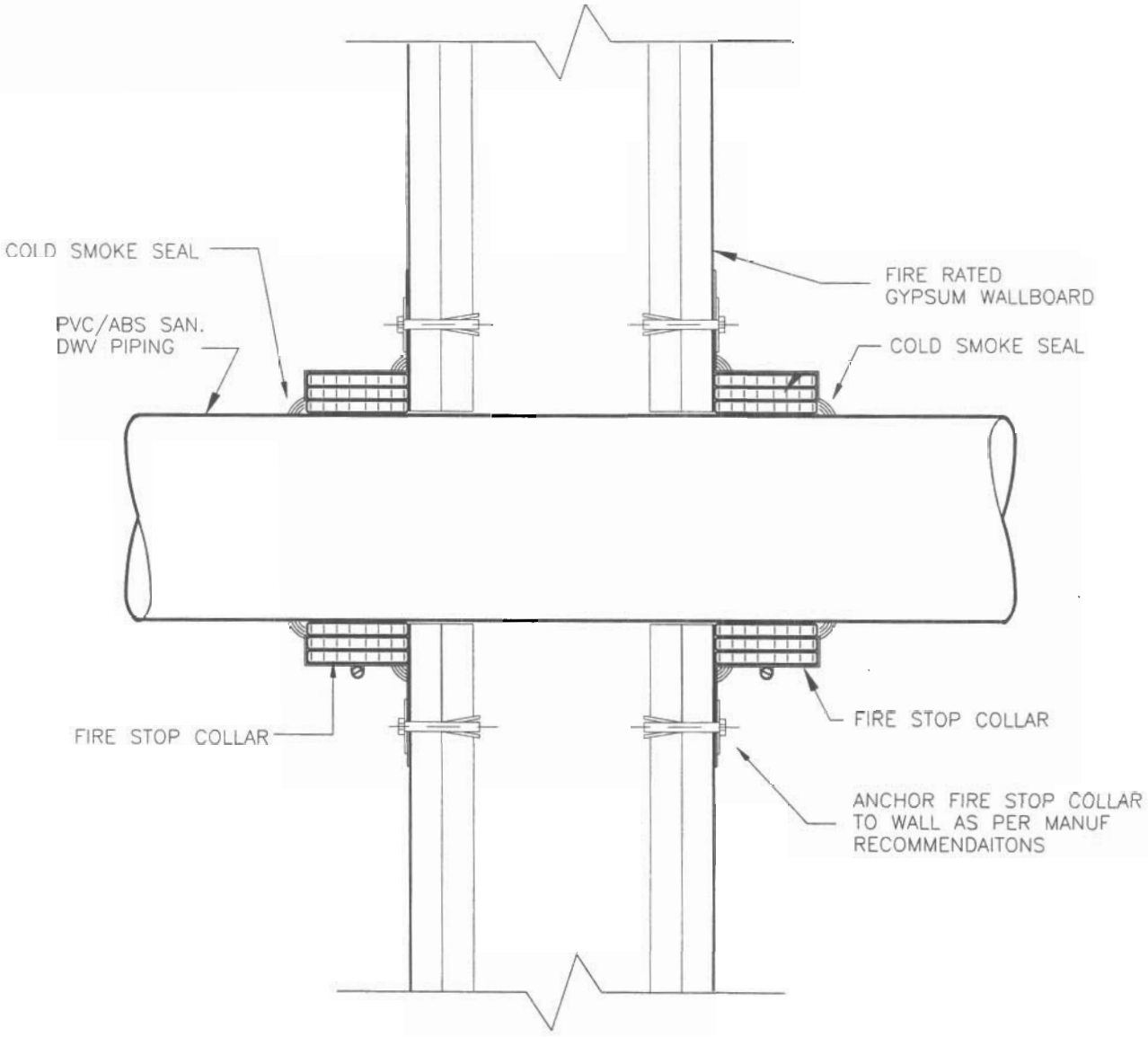
PIPE HANGER DETAIL



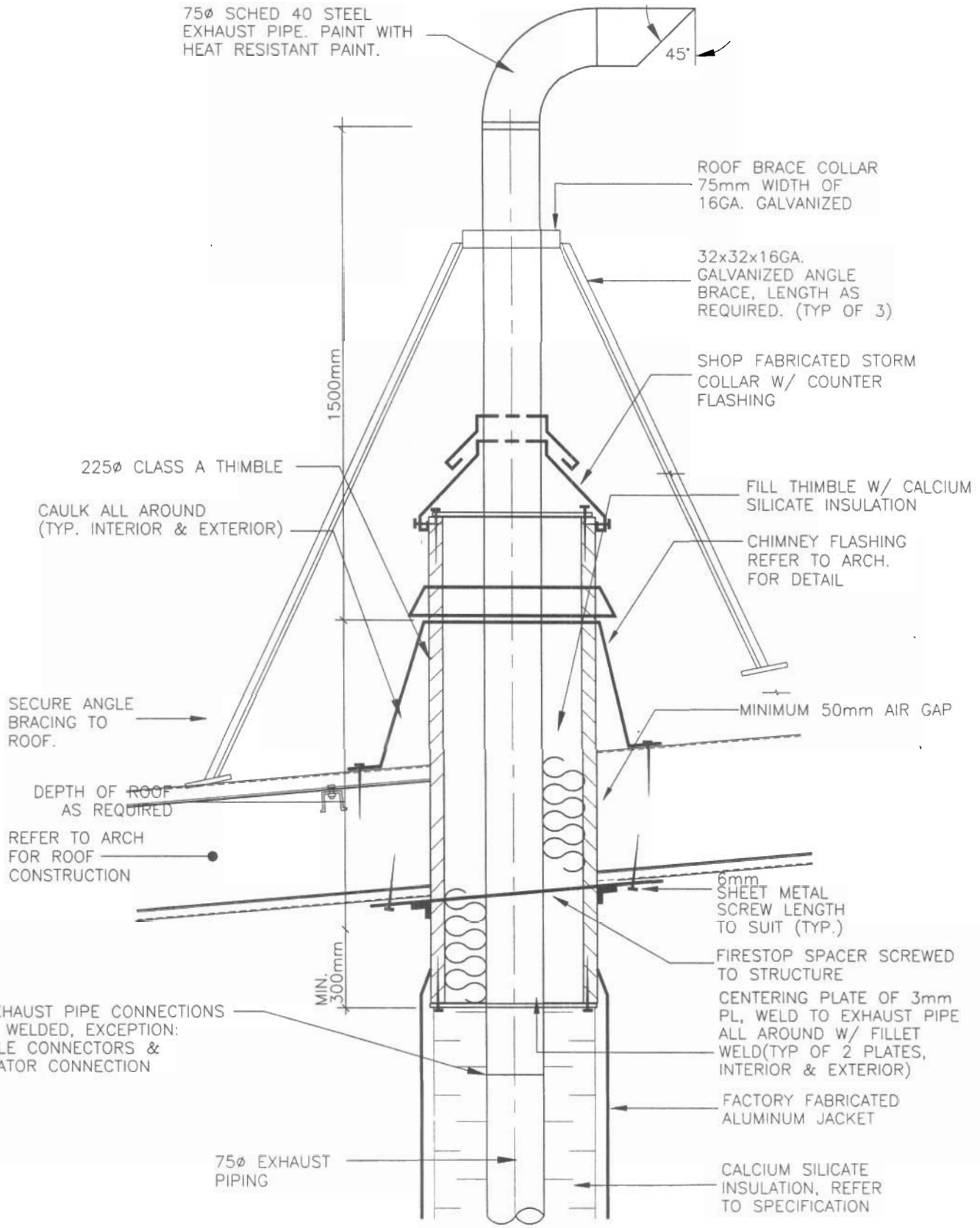
METALLIC INSULATED PIPE FIRE STOP DETAIL



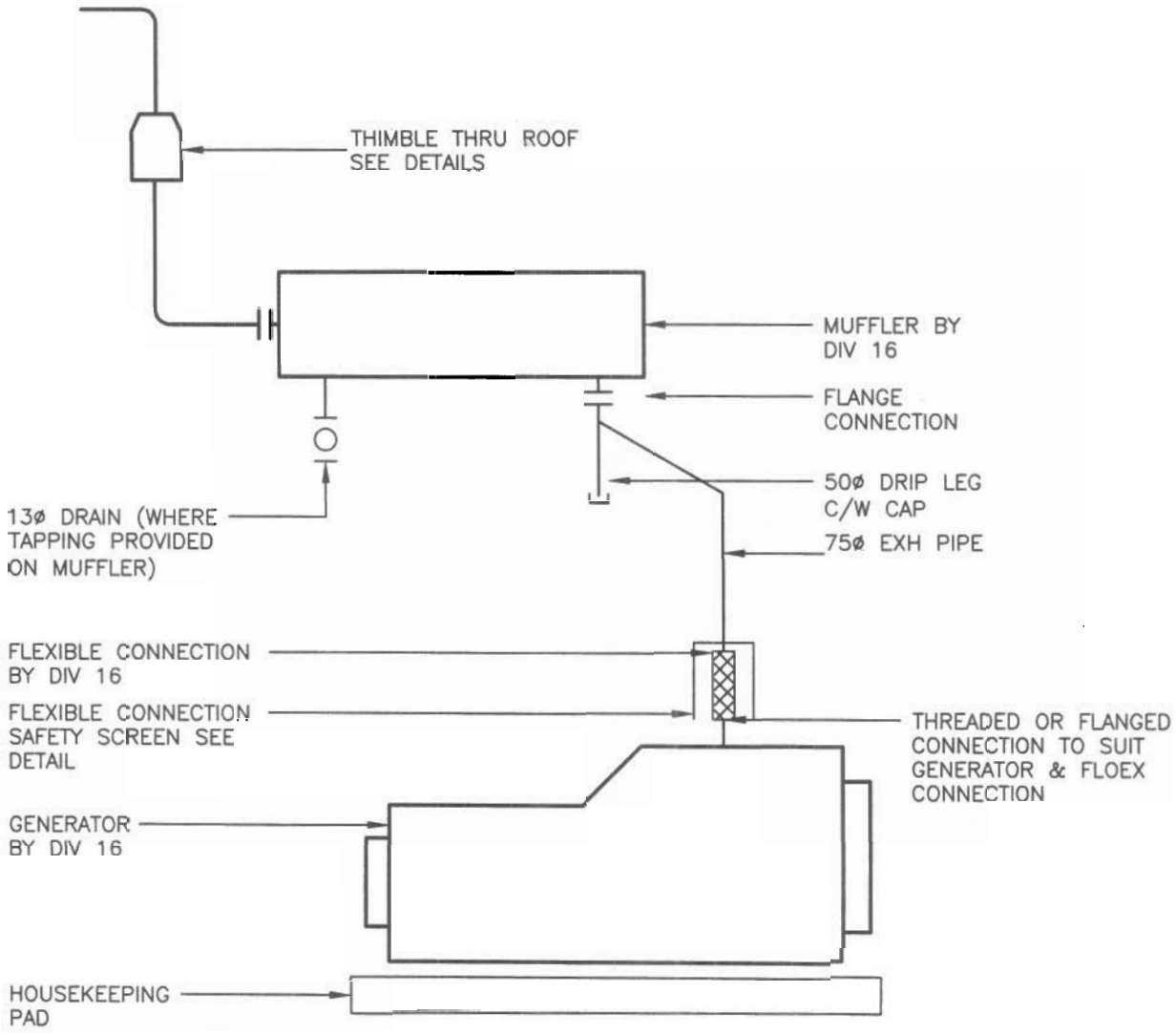
FIRE RATED PVC 50ø AND SMALLER PIPE FIRE STOP DETAIL



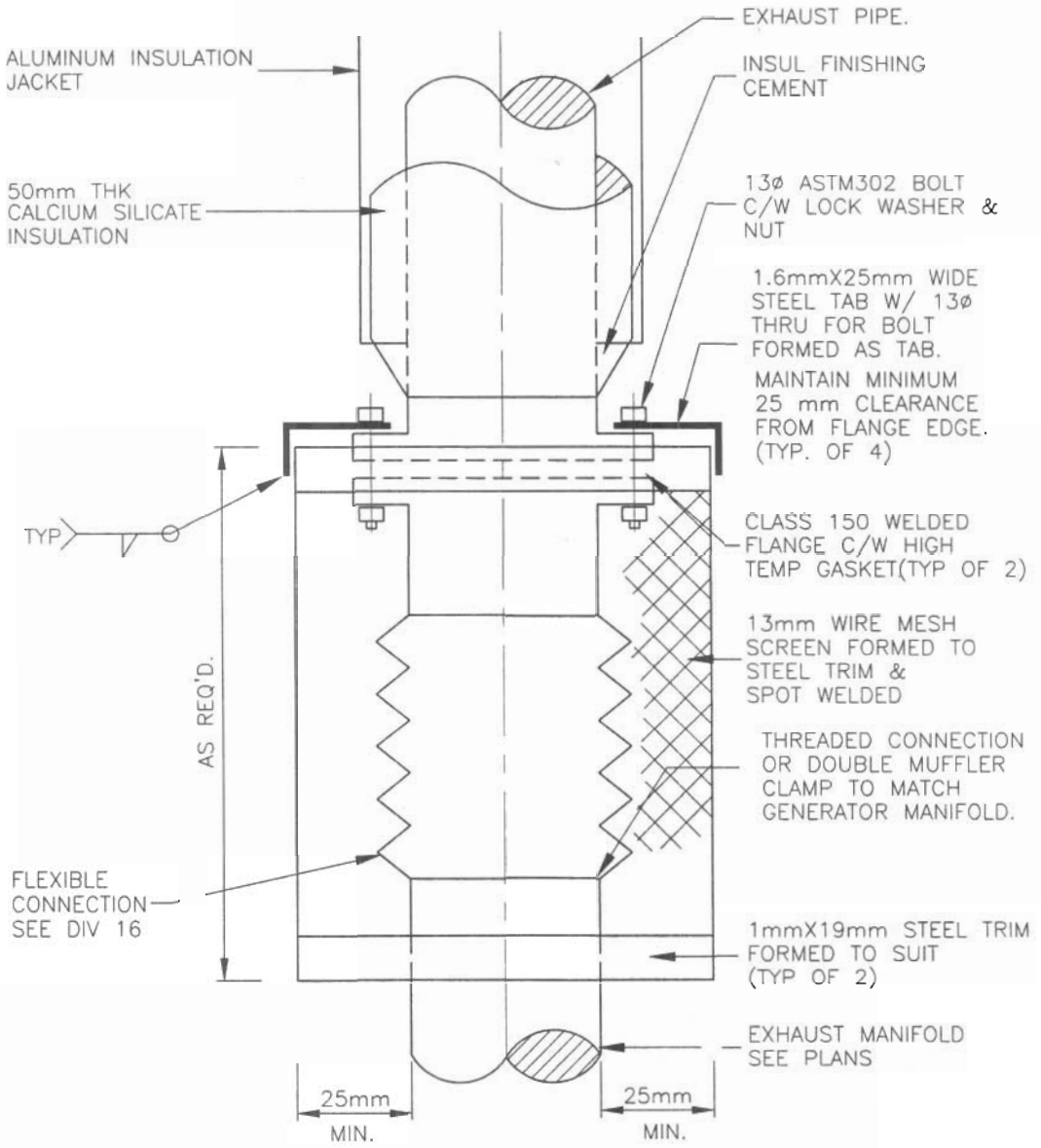
FIRE RATED PVC 63ø AND LARGER PIPE FIRE STOP DETAIL



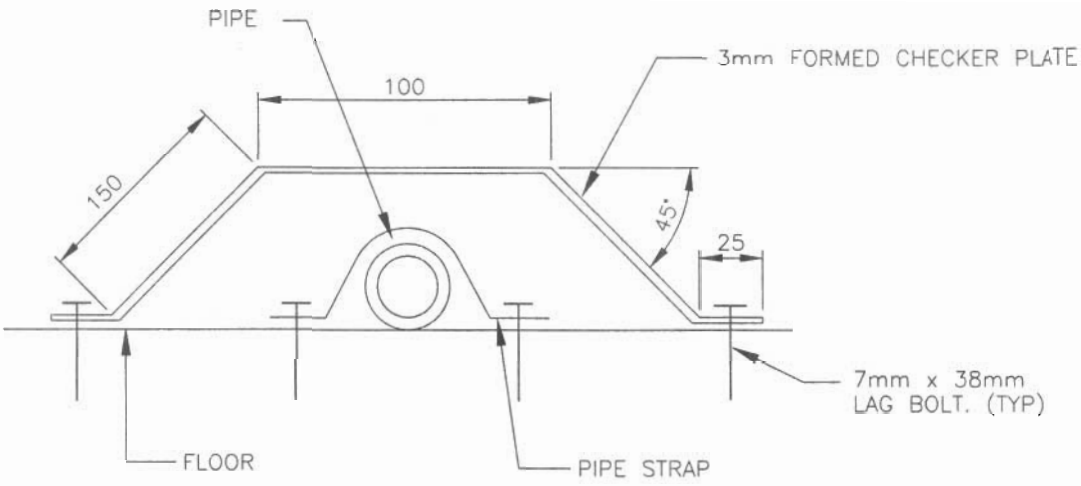
GENERATOR THIMBLE DETAIL



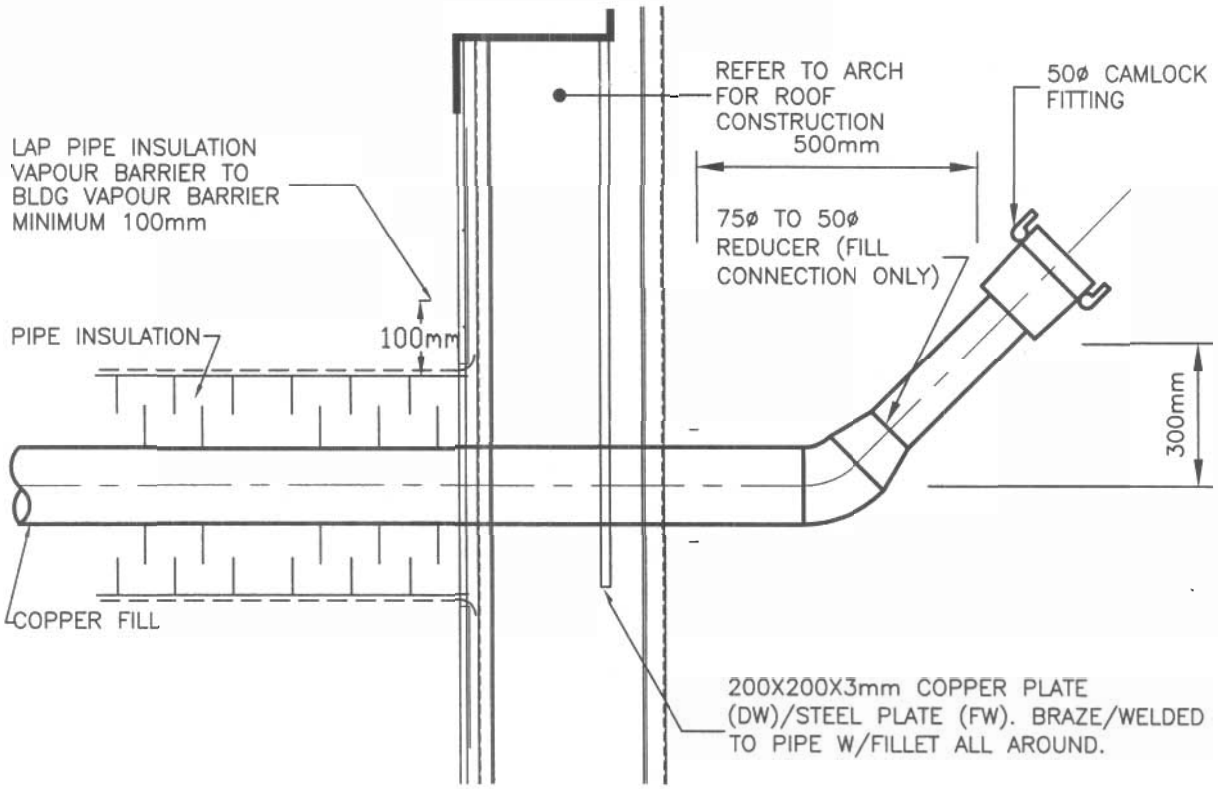
GENERATOR EXHAUST DETAIL



GENERATOR FLEXIBLE CONNECTION SAFETY SCREEN

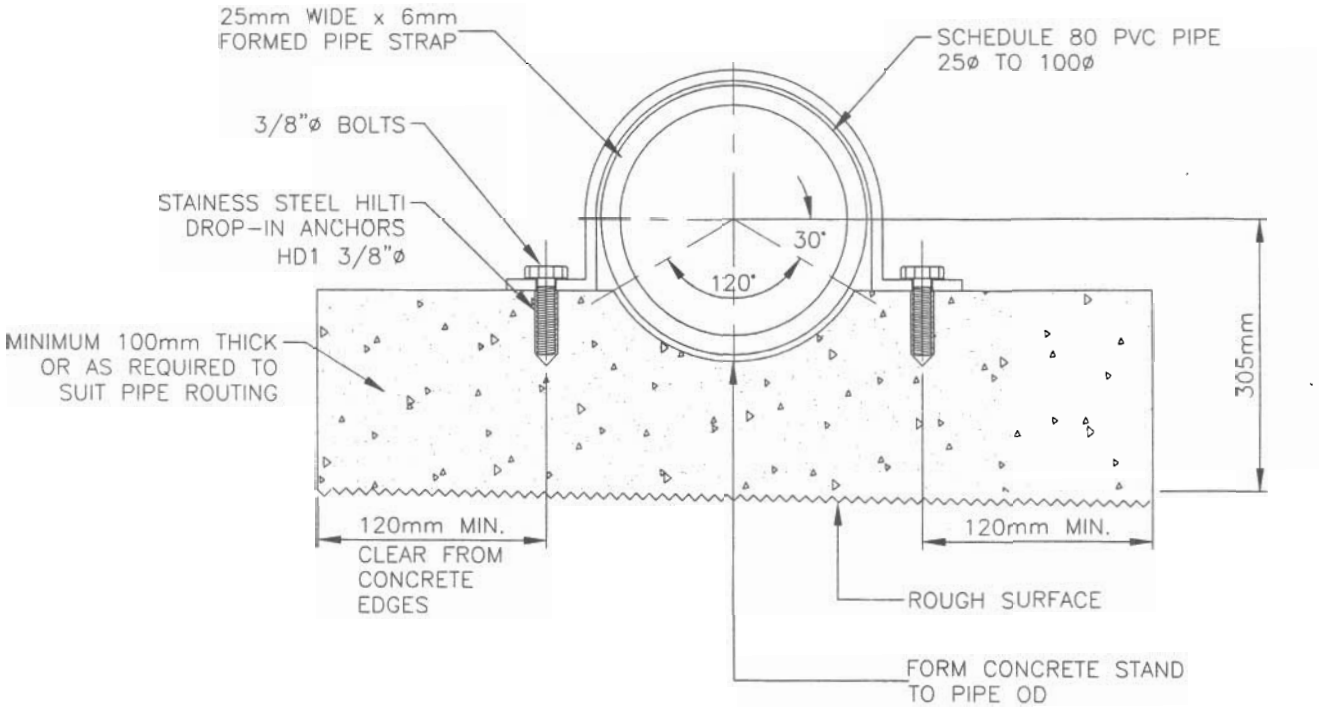


FLOOR MOUNTED PIPE COVER DETAIL

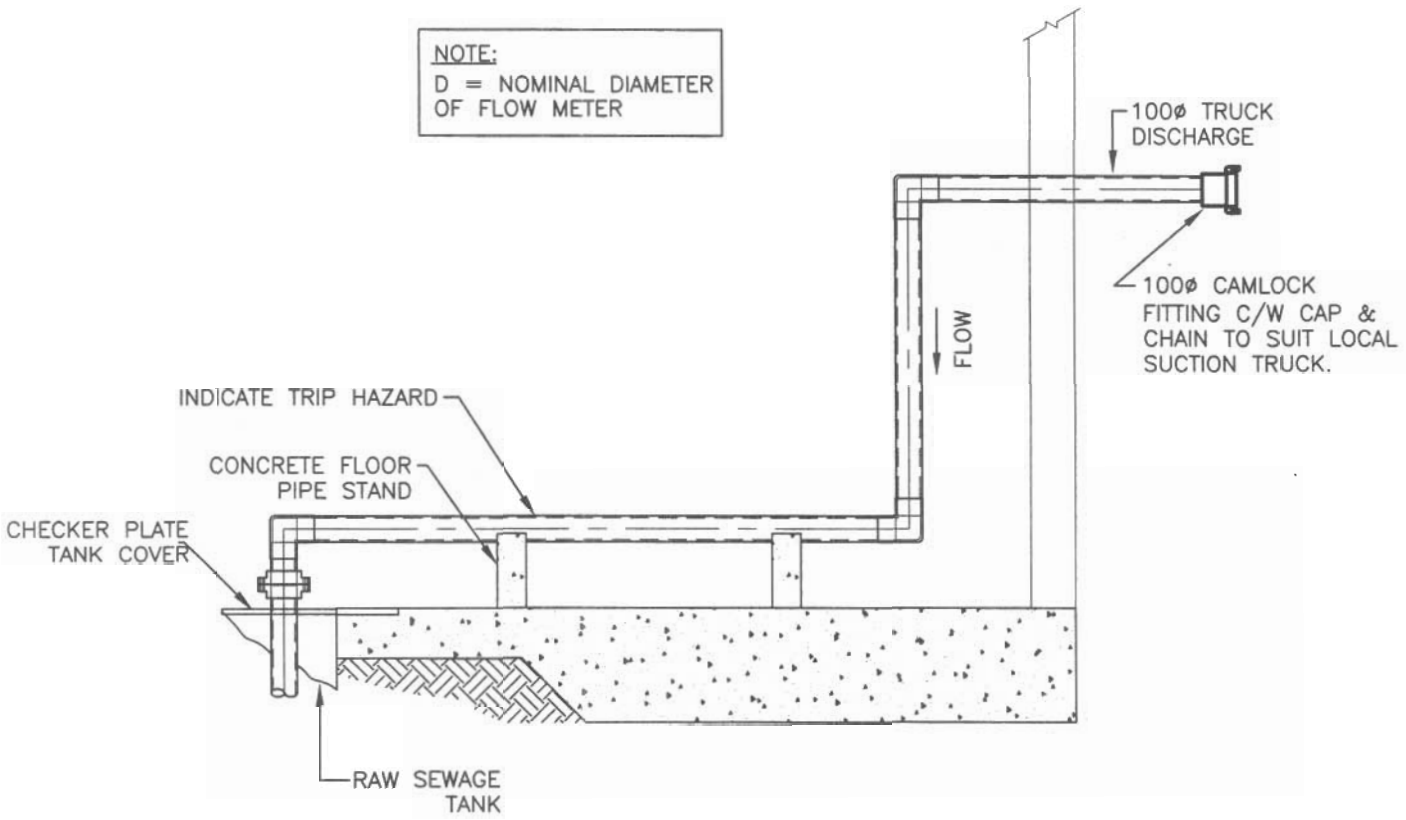


NOTES:
1. FOR VENT, AS ABOVE EXCEPT TERMINATE WITH 75ø ELL DOWN.
2. FOR LINE SIZE SEE PLANS.

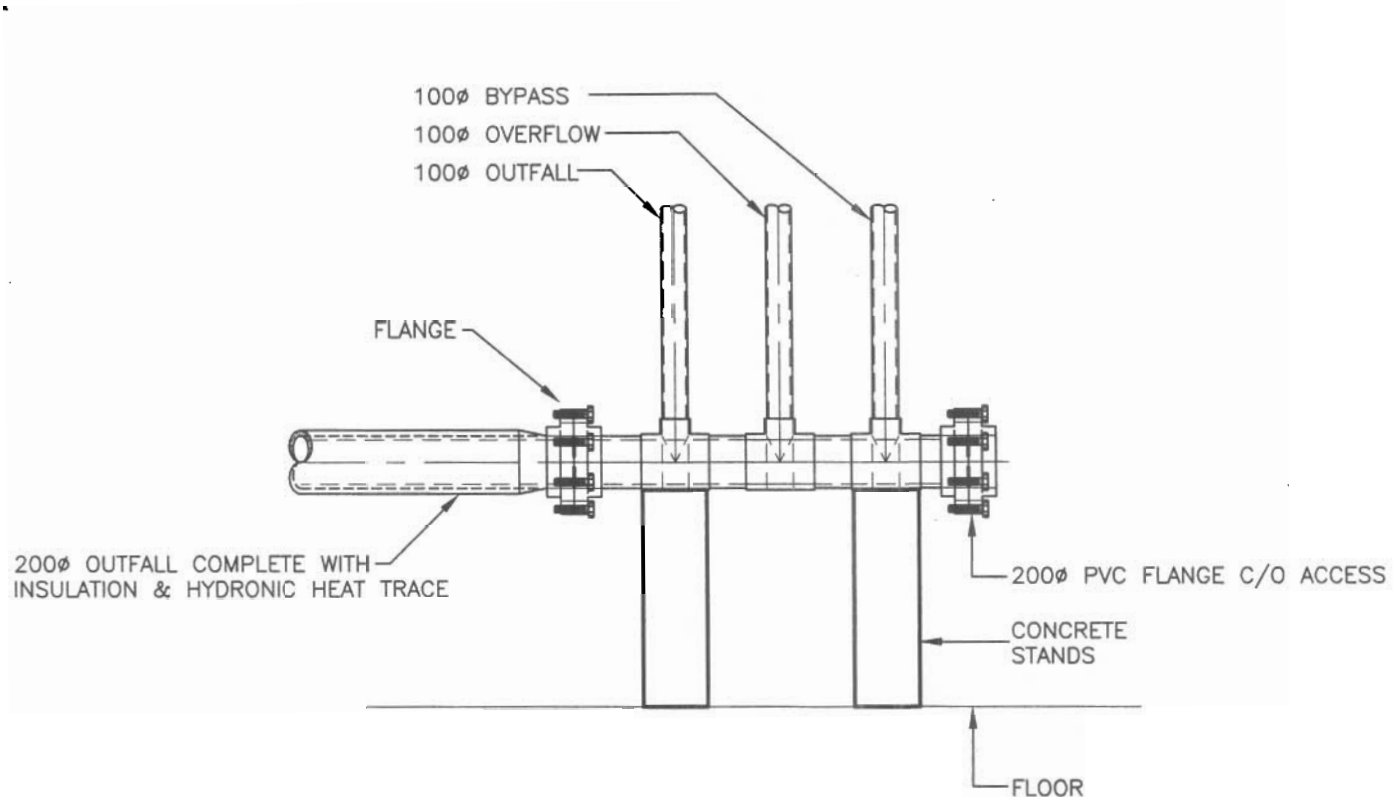
DOMESTIC WATER FILL/VENT DETAIL



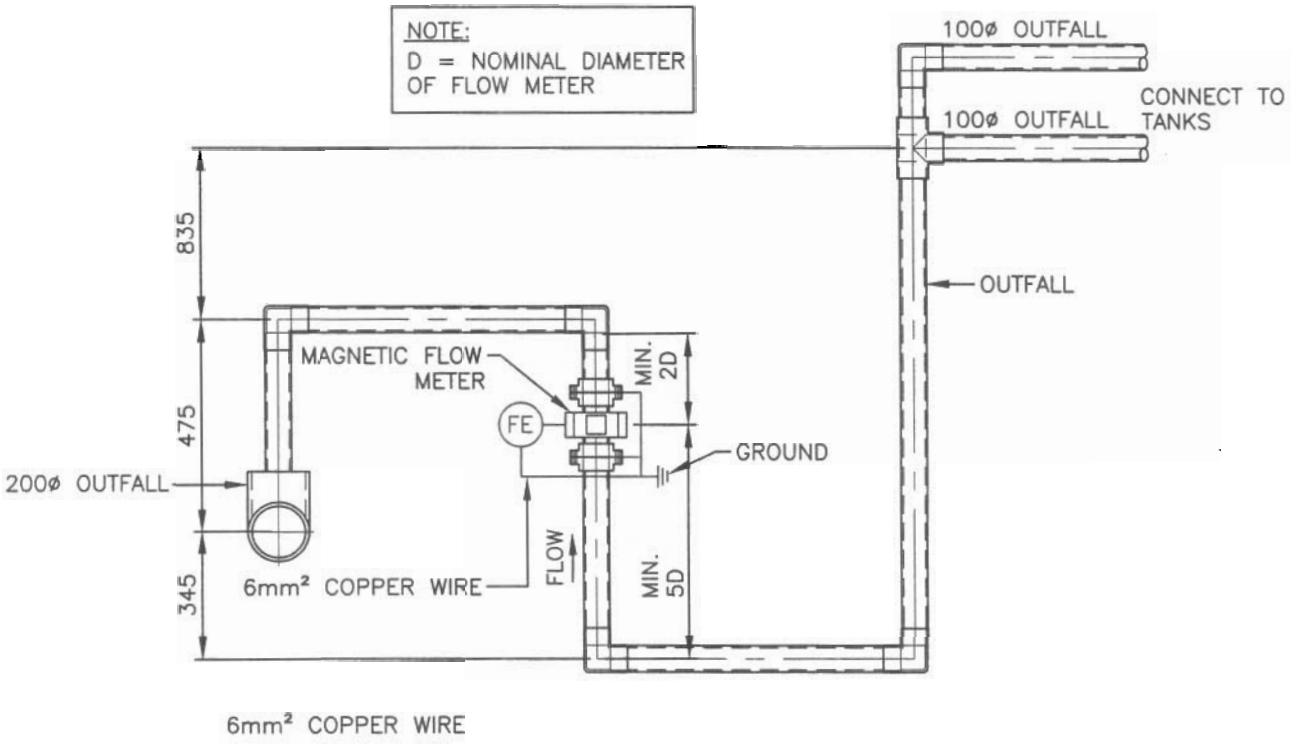
PIPING CONCRETE FLOOR STANDS DETAILS



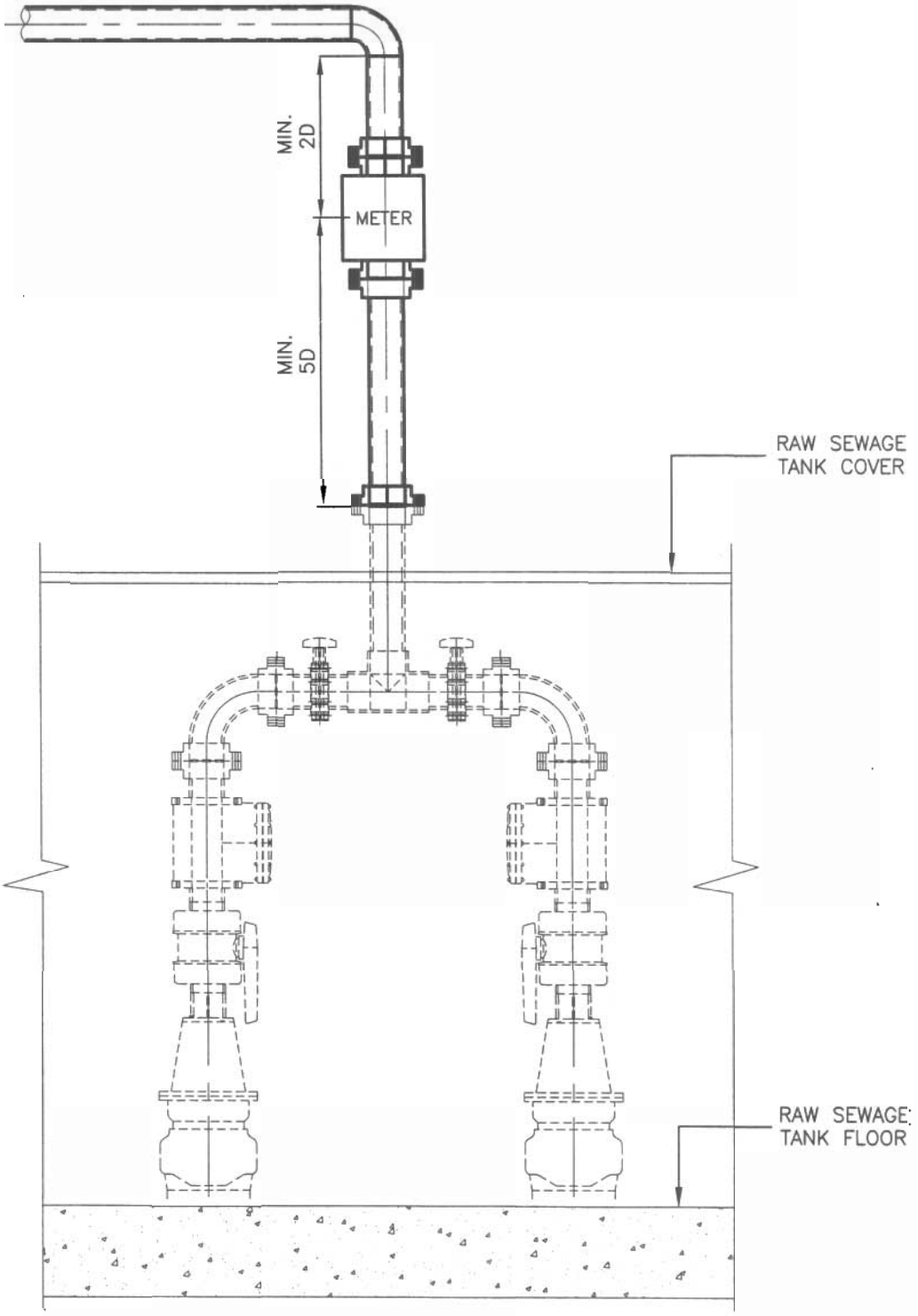
TRUCK DISCHARGE PIPING DETAIL



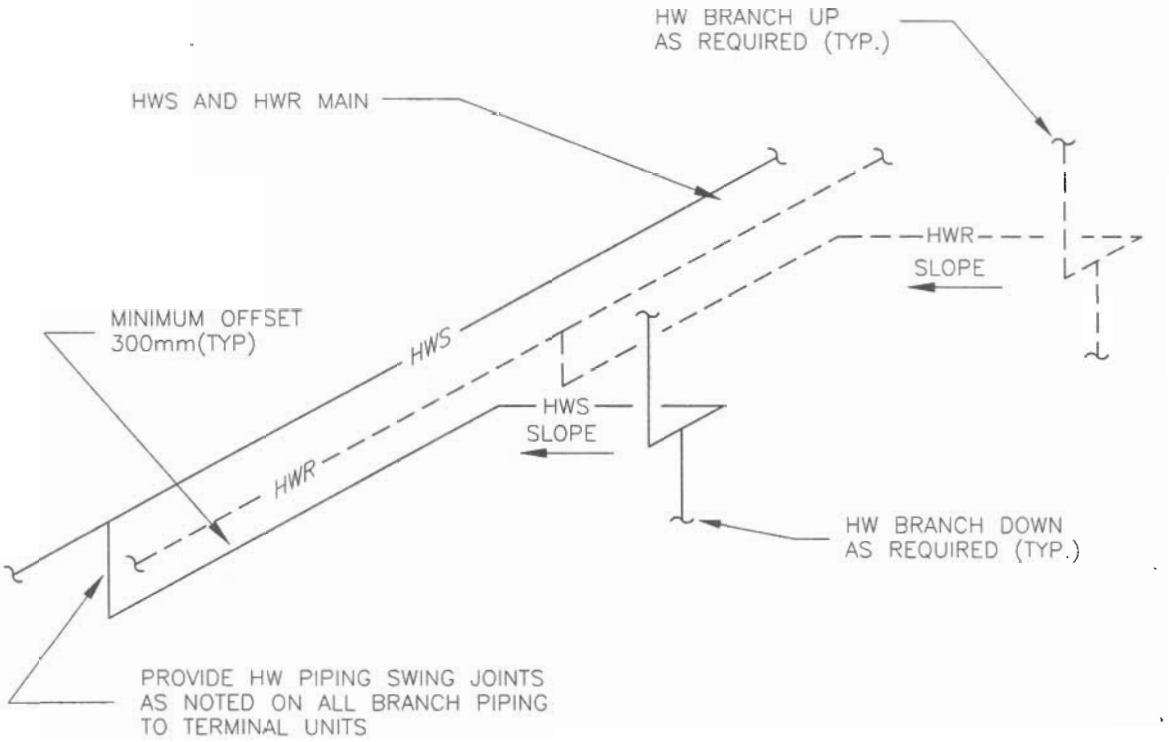
OUTFALL PIPING CONNECTIONS DETAIL



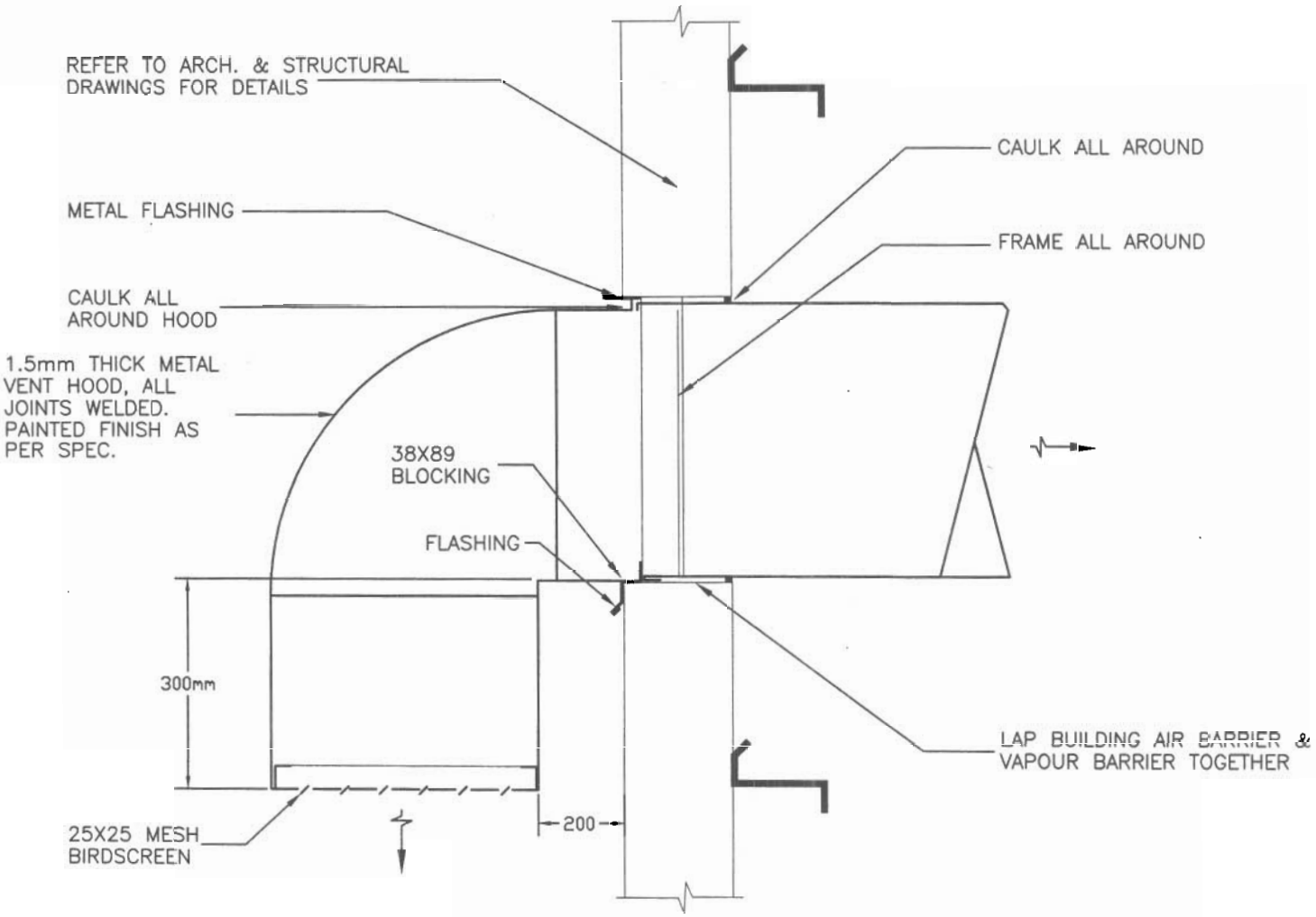
MAGNETIC FLOW METER INSTALLATION AND TRAP AT OUTFALL DETAIL



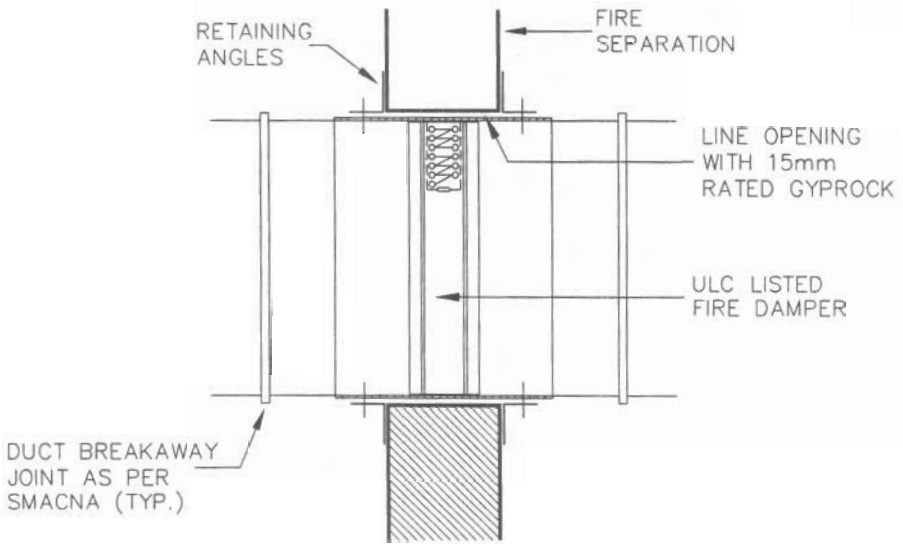
MAGNETIC FLOW METER INSTALLATION AT RAW SEWAGE TANK PUMP DISCHARGE



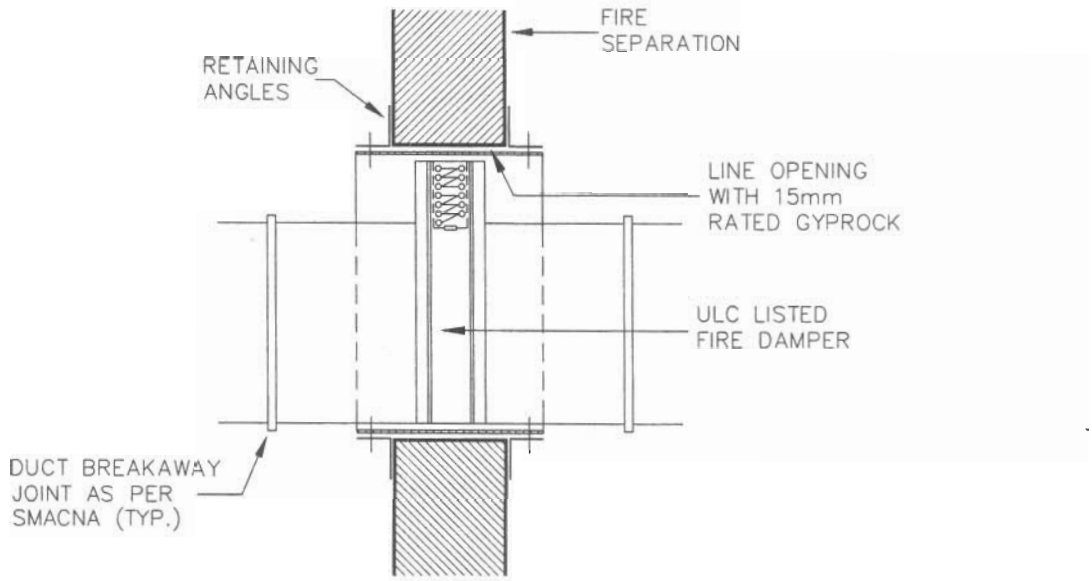
HW BRANCH CONNECTION DETAIL



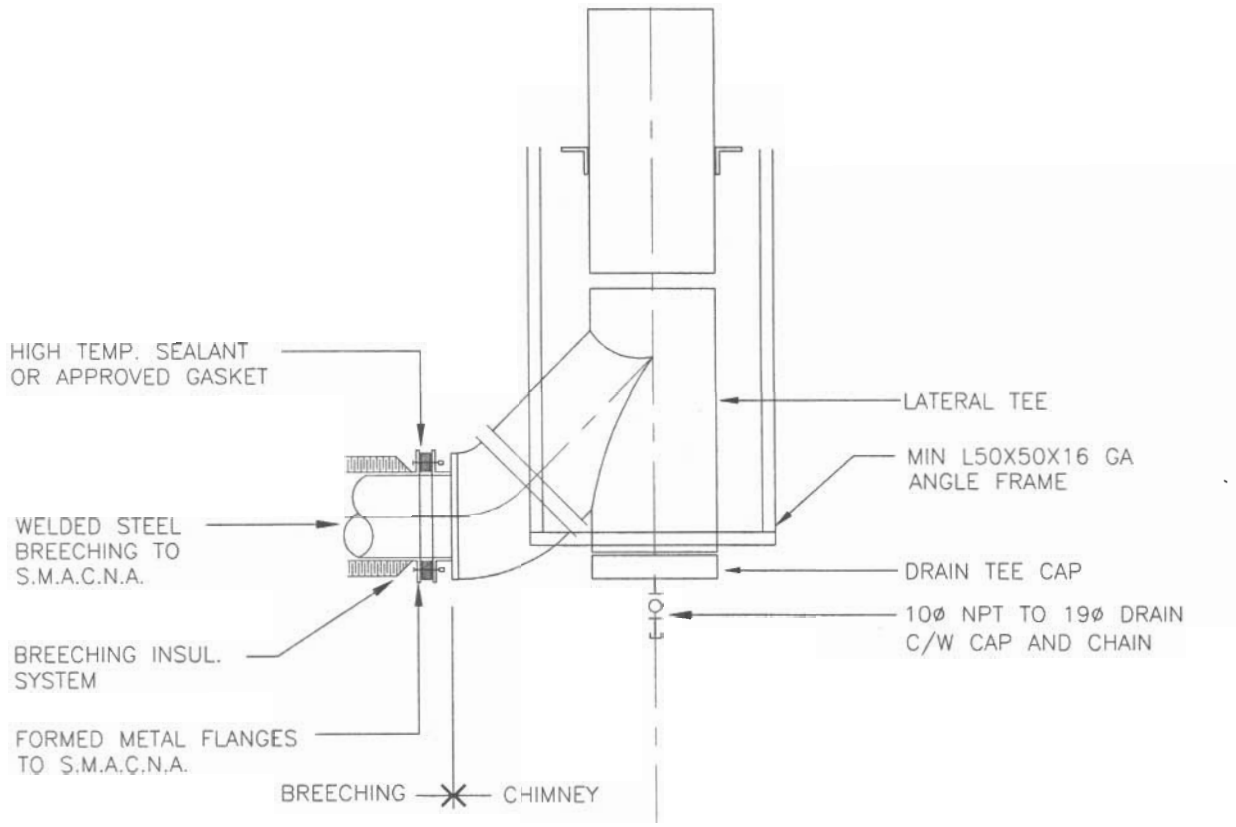
WALL HOOD DETAIL



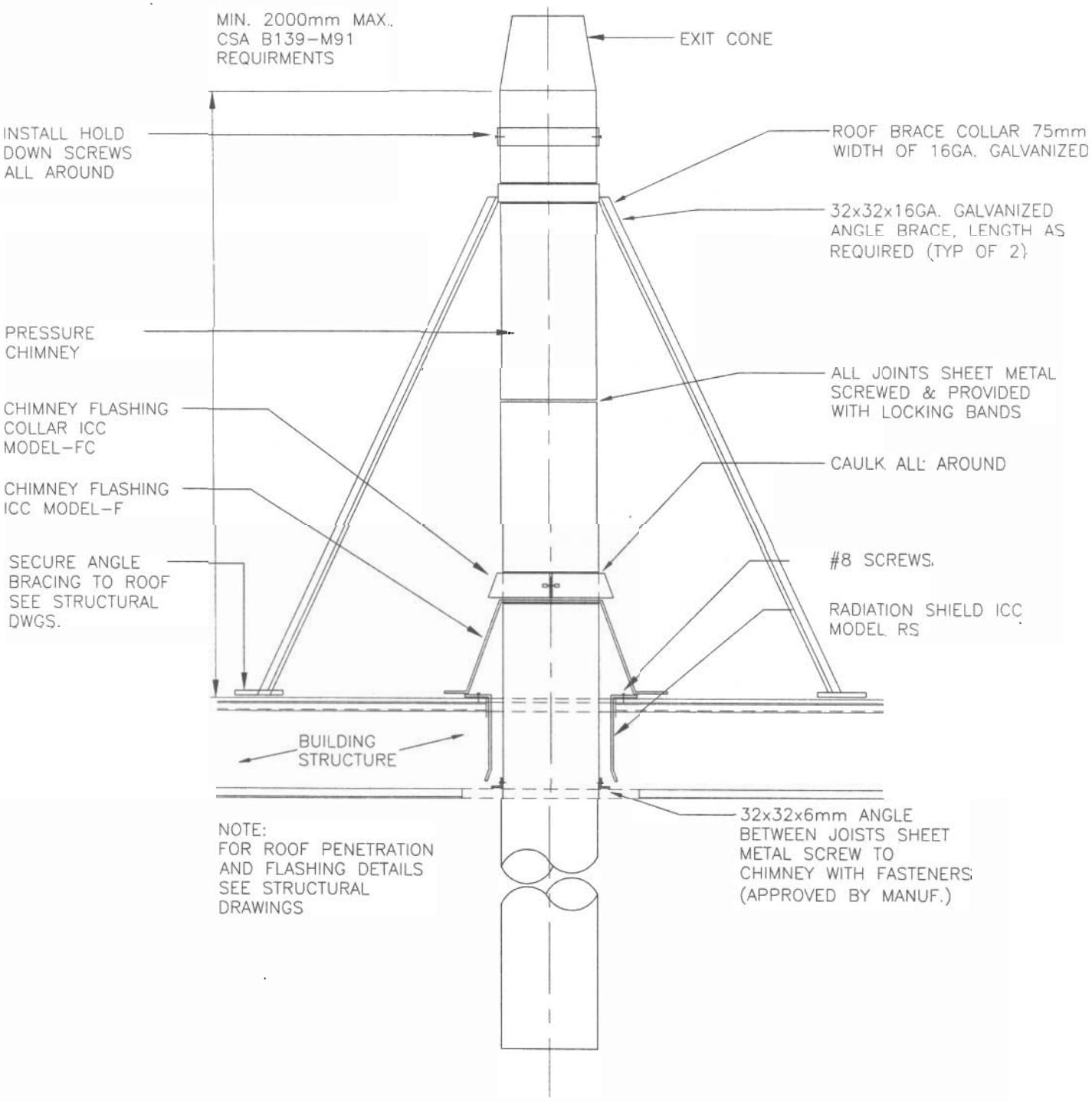
FIRE DAMPER DETAIL (TYPE 1)
(ACCEPTABLE WHERE APPROVED BY ENGINEER)



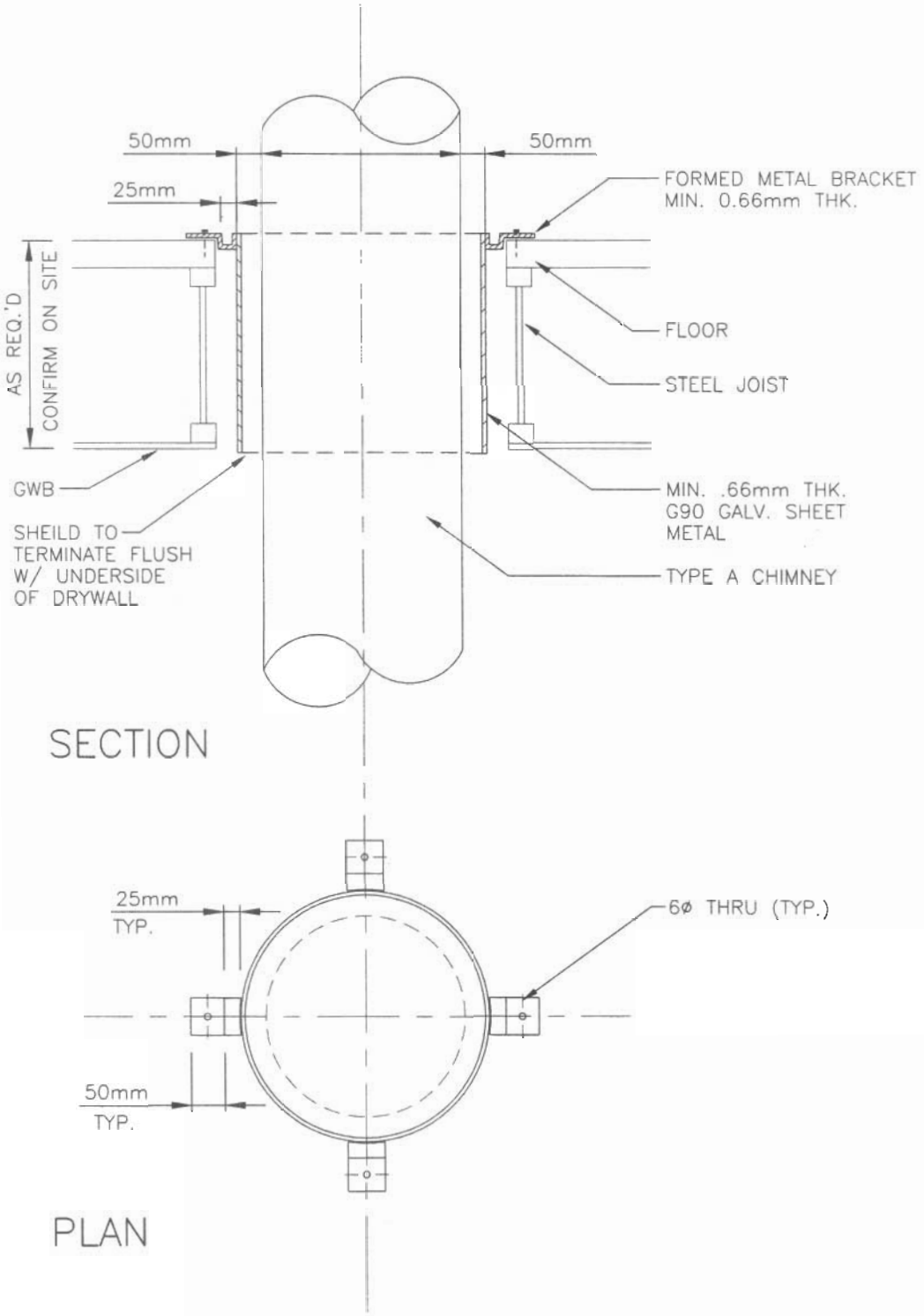
FIRE DAMPER DETAIL (TYPE 2)



BOILER CHIMNEY DETAIL (BOTTOM)



BOILER CHIMNEY DETAIL (TOP)



CHIMNEY RADIATION SHEILD DETAIL

Section	Title	Pages
Division 16 - Electrical		
16010	Electrical General Requirements	10
16111	Conduits, Conduit Fastening and Conduit Fittings	3
16122	Wires and Cables 0 - 1000 V	3
16131	Splitters, Junction, Pull Boxes and Cabinets	2
16132	Outlet Boxes, Conduit Boxes and Fittings	2
16141	Wiring Devices	3
16191	Fastenings and Supports	2
16238	Power Generation Diesel	14
16271	Dry Type Transformers Up To 600V Primary	3
16301	Automatic Load Transfer Equipment	6
16401	Overhead Service	2
16440	Disconnect Switches - Non-Fused Up to 1000 V	2
16450	Grounding - Secondary	3
16471	Panelboards Breaker Type	3
16477	Moulded Case Circuit Breakers	2
16485	Contactors	2
16505	Lighting Equipment	4
16519	Exit Lights	2
16537	Lighting - Central Emergency System	4
16592	Lighting Control Equipment Photoelectric	2
16703	Mechanical Alarm Detection System	1
16704	Alarm Annunciation System	2
16721	Fire Alarm System	11
16742	Incoming Telephone Service	1
16811	Motor Starters to 600 V	4
16990	Spare Parts	2

END

1 General	.1	This Section covers items common to Sections of Division 16. This section supplements requirements of Division 1.
2 Codes and Standards	.1	Do complete installation in accordance with CSA C22.1-98 except where specified otherwise.
	.2	Do underground systems in accordance with CAN/CSA-C22.3 No. 1-M87 except where specified otherwise.
	.3	Abbreviations for electrical terms: to CSA Z85-1983.
3 Care, Operation and Start-up	.1	Instruct Engineer and operating personnel in the operation, care and maintenance of equipment.
	.2	Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
4 Voltage Ratings	.1	Operating voltages: to C235-83.
	.2	Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
5 Permits, Fees and Inspection	.1	Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
	.2	Pay associated fees.
	.3	Engineer will provide drawings and specifications required by Electrical

5 Permits, Fees and Inspection (Cont'd)	.3	(Cont'd) Inspection Department and Supply Authority at no cost.
	.4	Notify Engineer of changes required by Electrical Inspection Department prior to making changes.
	.5	Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Engineer.
6 Materials and Equipment	.1	Provide materials and equipment in accordance with Section 01601 - Material and Equipment.
	.2	Equipment and material to be SCC (Standard Council of Canada) certified.
	.3	Factory assemble control panels and component assemblies.
7 Electric Motors, Equipment and Controls	.1	Responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings.
	.2	Control wiring and conduit is specified in Division 16 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 15 and shown on mechanical drawings.
	.3	Except where otherwise indicated, provide all feeders, breakers, disconnects, starters overloads and power relays as indicated on drawings.
8 Finishes	.1	All electrical fittings, supports hanger rods, pullboxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc. to have galvanized finish or enamel paint finish over corrosion-resistant primer.
	.2	All panelboards, distribution centres, transformers, motor control centres, etc. to be factory finished in gloss air dry enamel

8 Finishes (Cont'd)

.2 (Cont'd) applied over corrosion-resistant primer. Matte or flat type finish paint not acceptable. Factory finished units that are scratched or marked during installation or shipping to be touched up with matching spray-on air dry lacquer or, if required to provide a satisfactory job, completely refinished.

.3 All 120/208 volt equipment to be finished in grey, CIL-BH 94351.

.4 Telephone terminal panels and junction boxes to be finished in white.

9 Equipment Identification

.1 Identify electrical equipment with nameplates and labels as follows:

.2 Nameplates:
.1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50	mm	1 line	3 mm high letters Type C
Size 2	12 x 70	mm	1 line	6 mm high letters Type B
Size 4	20 x 90	mm	1 line	9.5 mm high letters Type A

.3 Labels:
.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Engineer/Consultant prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English.

9 Equipment Identification (Cont'd)

.7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.8 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.9 Terminal cabinets and pull boxes: indicate system and voltage.

.10 Transformers: indicate capacity, primary and secondary voltages.

.11 On/Off switches: indicate areas being served.

10 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1-98 red, black, blue, with neutral white.

.4 Use colour coded wires in communication cables, matched throughout system.

11 Conduit and Cable Identification

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
.1 Colour coding to be as follows:

11 Conduit and Cable Identification (Cont'd)	.3	Colours:(Cont'd) .1 Colour coding to be as follows:(Cont'd) 120/208 volt normal/standby power - grey. Telephone - white. D.C. emergency lighting - black with red band. Mechanical Alarm - black with yellow band.
12 Wiring Terminations	.1	Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
13 Manufacturers and CSA Labels	.1	Visible and legible after equipment is installed.
14 Electrical Diagrams	.1	Provide electrical diagrams as follows: .1 Electrical distribution system: Full singleline distribution to drafting standards of tender documents. Locate in main electrical room.
	.2	Drawings: 600 x 600 mm minimum size, framed with plexiglass covers and securely affixed to the walls at the required locations.
15 Location of Outlets	.1	Locate outlets in accordance with Section 01001 - General Requirements.
	.2	Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
	.3	Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before rough-in of outlet.

15 Location of Outlets (Cont'd)

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical room on latch side of door.

16 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1050 mm.

.2 Wall receptacles:

.1 General: 350 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone outlets: 350 mm.

.5 Outlets for wall mounted telephones or intercoms: 1200 mm.

17 Load Balance

.1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain balance of current between phases to within 15% of average and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment..

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

18 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 Obtain prior approval from Consultant before installing any equipment or conduit through roofing membrane. Provide approved pitch pockets or roof jacks where approval is given.

19 Field Quality Control

.1 Conduct and pay for all testing except where otherwise indicated.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 Insulation resistance testing.
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of Engineer.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Complete all deficient items noted on reports provided by the local authority having jurisdiction.

.7 Submit test results for Engineer's review.

20 Co-ordination of Protective Devices	.1	Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
21 Backboards	.1	All electrical backboards to be painted with fire retardant matte black paint.
22 Demonstration and Operating and Maintenance Instructions	.1	Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
	.2	Manufacturers to provide demonstrations and instructions where specified.
	.3	Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
	.4	Operating personnel shall be contacted at the beginning of the project and encouraged to come on site at least once a week for the duration of the project. During these periods, they shall be given full explanation of the various systems as the project progesses.
	.5	Two weeks prior to interim inspection, operating personnel shall be given instruction for a period of one week with minimum of two hours per day. Instruction to be provided during regular work hours.
	.6	Maintain log of all site visits. Maintenance personel to login/out and be witnessed by Contractor. Provide log as requested.

23 Operation and Maintenance Data	.1	Include in Operation and Maintenance Data: .1 Component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation. .2 Wiring and schematic diagrams indicating all connections, terminals and wire numbers. .3 Names and address of all suppliers for items must be included in the Maintenance Manuals. .4 All manufacturer's operating and maintenance information prepared for any installed equipment. .5 Shop drawings of all install equipment. .6 Results of all tests performed. .7 Spare parts list. .8 All testing certificates and Inspection Department acceptance. .9 Panel Schedules .10 Copies of items in 16 of this Section.
24 Shop Drawings and Product Data	.1	In accordance with Section 01300 - Submittals.
25 As-built Drawings	.1	As built drawings as per Section 01300: .1 Contractor to provide 1 set of marked up electrical as-built drawings. Provide sets of white prints of the construction drawings. Mark thereon all changes as work progresses and as changes occur. This shall include changes to all electrical systems as shown in the tender documents. Ensure that items marked correspond to the drawing title. .2 Use different colour waterproof ink for each service on a per drawing basis. .3 Make mark-ups available for reference purposes and inspection at all times.
	.2	Present finalized as-built mark up drawings to Engineer/Consultant at time of interim inspection.

26 Contract Breakdown

.1 Provide separate material and labour breakdown for the total Division 16 sub-contract as indicated below. This breakdown is to meet the satisfaction of the Consultant and

is to be submitted within 14 days of contract

.2 The breakdown will be used in computing of progress claims. Progress claims are to be itemized with separate labour and material listing against each item of the contract breakdown:

.1 Mobilization
.2 Service and Distribution
.3 Lighting
.4 Power Branch Circuitry
.5 Emergency Lighting and Low Tension
.6 Mechanical Equipment Provisions
.7 Specialty Items

END

PART 1 - GENERAL

1.1 Location of Conduit	.1	Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

PART 2 - PRODUCTS

2.1 Conduits	.1	Rigid galvanized steel threaded conduit.
	.2	Electrical metallic tubing (EMT): with couplings.
	.3	Rigid pvc conduit.
	.4	Flexible steel conduit and liquid-tight flexible metal conduit.
2.2 Conduit Fastenings	.1	One hole malleable iron straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
	.2	Beam clamps to secure conduits to exposed steel work.
	.3	Six mm dia threaded rods to support suspended channels.
2.3 Conduit Fittings	.1	Fittings: manufactured for use with conduit specified. Coating: same as conduit.
	.2	Factory "ells" where 90° bends are required for 25 mm and larger conduits.
	.3	Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 Expansion Fittings for Rigid Conduit

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Weatherproof expansion fittings for linear expansion at entry to panel where indicated.

2.5 Fish Cord

.1 Polypropylene.

PART 3 - EXECUTION

3.1 Installation

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and/or in unfinished areas.

.3 Use rigid galvanized steel threaded conduit where specified.

.4 Use electrical metallic tubing (EMT) except where subject to mechanical injury.

.5 Use rigid pvc conduit underground.

.6 Use liquid tight flexible metal conduit for connections to motors or vibrating equipment.

.7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend steel conduit over 19 mm dia.

.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.10 Install fish cord in empty conduits.

3.1 Installation (Cont'd)

.11 Run 2-25 mm spare conduits up to ceiling space. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space.

.12 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended surface channels. Channels to have 25% spare capacity.

.4 Do not pass conduits through structural members except as indicated.

.5 Do not locate conduits less than 75 mm parallel to hot water lines with minimum of 25 mm at crossovers.

3.3 Concealed Conduits

.1 Do not install horizontal runs in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings.

END

PART 1 - GENERAL

1.1 References

.1 CSA C22.2-94. 0.3-92, Test Methods for Electrical Wires and Cables.

1.2 Product Data

.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Building Wires

.1 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 minimum #12 B & S gauge.

.2 Conductors: stranded for 10 AWG and larger.

.3 Non-Metallic Sheathed Cable (NMD90) is not allowed in this facility.

2.2 TECK Cable

.1 Conductors:
.1 Grounding conductor: copper.
.2 Circuit conductors: copper, size as indicated.

.2 Insulation:
.1 Chemically cross-linked thermosetting polyethylene rated type RW90 XLPE 1000V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking galvanized steel.

.5 Overall covering: polyvinyl chloride material.

.6 Fastenings:
.1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
.2 Channel type supports for two or more cables at 1500 mm centers.

2.2 TECK Cable (Cont'd)

.6 Fastenings: (Cont'd)
.3 Six mm diam threaded rods to support suspended channels.

.7 Connectors:
.1 Watertight approved for TECK cable.

2.3 Armoured Cables

.1 Conductors: insulated, copper, minimum size to be #12 B & S gauge.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Bx cable only to be used for fixture drops.

2.4 Control Cables

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of cotton braid thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Low energy 300 V control cable: solid stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40°C TWH polyethylene insulation with shielding of tape coated with paramagnetic material tape coated with diamagnetic material wire braid metallized tapes over each conductor pair group over all conductors and overall covering of PVC jackets polyethylene jackets lead sheath aluminum sheath interlocked armour of flat galvanized steel aluminum strip copper strip.

PART 3 - EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 16111.
.2 Overhead service conductors in accordance with Section 16401.

3.2 Installation of Armoured Cables

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 16151 - Wire and Box Connectors - 0 - 1000 V.

3.3 Installation of Control Cables

.1 Install control cables in conduit.

.2 Ground control cable shield at one end only.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data for cabinets in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Splitters

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs and/or connection bars to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 Junction and Pull Boxes

.1 Pull boxes and junction boxes code gauge metal construction and/or cast corrosion - resistant type, conforming to Canadian Electrical Code, with screw on or hanged cover.

2.3 Cabinets

.1 Cabinets: Code gauge metal prime coated, locking door, concealed flush hinges, flush lock and catch assembly.

.2 Terminal Strips:
.1 Below 50 volts - screw terminal type, Armaco T12-2 or Cinch Series 500.
.2 Above 50 volts - 250 volt screw terminal type with barriers between each set of terminal with individual terminal points for each conductor.

.3 Signage: number identify terminal strips with permanent numbers. Provide wiring diagram on inside of terminal cabinet door showing units and conductors connected to terminal cabinet.

2.3 Cabinets (Cont'd)

.4 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.5 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (coated with fire retardent paint) for surface or flush mounting as indicated on drawings.

PART 3 - EXECUTION

3.1 Junction, Pull Boxes and Cabinets Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical - General Provisions.

.2 Install Type B identification labels indicating system name, voltage and phase.

END

PART 1 - GENERAL

1.1 References .1 CSA C22.1-98 Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1-98.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Sheet Steel Outlet Boxes

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized pressure steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 Boxes for Rigid Steel Conduit

.1 Cast FS or FD aluminum feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle and exterior devices. To be Crouse Hinds or approved equivalent.

2.4 Fittings-General

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings or sheet metal boxes.

PART 3 - EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Switches

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches.

.2 Manually-operated general purpose ac switches with following features:
.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea molding for parts subject to carbon tracking.
.4 Suitable for side wiring.
.5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 All switches to be specification grade.

.6 Acceptable materials: Hubbell HBL Series or Leviton 1100 Series.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
.1 Suitable for No. 10 AWG for side wiring.
.2 Break-off links for use as split receptacles.
.3 Four side wiring screws.
.4 Triple wipe contacts and rivetted grounding contacts.

2.2 Receptacles (Cont'd)

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 All receptacles to be specification grade.

.5 Acceptable materials: Hubbell 5242 Series or Leviton 5242 Series.

2.3 Special Wiring Devices

.1 Switches with Pilot Lights:
.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel flush type.
.2 Lighted Toggle Switch: toggle action type with ivory nylon handle, one way or three way as indicated, light on with load off, rated 15 amp, 120 volt, 1/2 hp.

2.4 Cover Plates

.1 Cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box and devices mount in finish areas.

.5 Sheet metal cover plates for wiring devices mounted in mechanical and electrical rooms FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

PART 3 - EXECUTION

3.1 Installation

.1 All wiring devices to be fed from "pigtail" splices. Feed through splices utilizing the devices as a splicing terminal is not acceptable.

.2 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 16010 - Electrical General Requirements or as indicated.

.3 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 16010 - Electrical General Requirements or as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount receptacles with u-ground on the bottom of the receptacle.

.4 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END

PART 1 - GENERAL

1.1 Related Work	.1	Fastenings and supports:	Section 01600 Material and Equipment

PART 2 - PRODUCT

2.1 Support Channels	.1	U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended, set in poured concrete walls and ceilings.

PART 3 - EXECUTION

3.1 Installation	.1	Secure equipment to hollow solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
	.2	Secure equipment to poured concrete with expandable inserts.
	.3	Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
	.4	Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
	.5	Fasten exposed conduit or cables to building construction or support system using straps. .1 One-hole malleable iron steel straps to secure surface conduits and cables 50 mm and smaller. .2 Two-hole steel straps for conduits and cables larger than 50 mm. .3 Beam clamps to secure conduit to exposed steel work.

3.1 Installation (Cont'd)

.6 Suspended support systems.
.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 2 m oc spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.13 Where screw fastenings are used on metal decking, screws are to be set in lower flutes only.

END

PART 1 - GENERAL

1.1 References

.1 ANSI/API 650-1992, Welded Steel Tanks for Oil Storage.

.2 ANSI/NEMA MG1-1993, Motors and Generators.

.3 CAN/CGSB-3.6-M90, Automotive Diesel Fuel.

.4 ISO 3046/1-1981, Specification for Reciprocating Internal Combustion Engines: Performance.

.5 ULC-S601-93, Steel, Aboveground Horizontal Tanks for Flammable and Combustible Liquids.

.6 CAN/ULC-S603-92, Steel Underground Tanks for Flammable and Combustible Liquids.

1.2 Description of System

.1 Generating system consists of:

.1 Diesel engine.
.2 Alternator.
.3 Alternator control panel.
.4 Automatic transfer equipment.
.5 Battery charger and battery.
.6 Automatic engine room ventilation system.
.7 Fuel supply system.
.8 Exhaust system.
.9 Steel mounting base.
.10 Synchronizing panel.
.11 Automatic/Manual transfer switch.

.2 System designed to operate as standby service to operate unattended.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

1.3 Shop Drawings (Cont'd)

.2 Include:

.1 Engine: make and model, with performance curves.

.2 Alternator: make and model.

.3 Voltage regulator: make, model and type.

.4 Automatic transfer switch: make, model and type.

.5 Battery: make, type and capacity.

.6 Battery charger: make, type and model.

.7 Alternator control panel: make and type of meters and controls.

.8 Governor type and model.

.9 Automatic engine room ventilation system.

.10 Cooling air requirements in m^3/s.

.11 British standard or DIN rating of engine.

.12 Flow diagrams for:

.1 Diesel fuel.

.2 Lubricating Oil.

.3 Cooling air.

.13 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.

.14 Continuous full load output of set at 0.8 PF lagging.

.15 Description of set operation including:

.1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.

.2 Manual starting.

.3 Automatic shut down and alarm on:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.4 Alarm On:

.1 Alternator overvoltage.

.2 Lube oil high temperature.

.3 Thermistor over temperature on alternator.

.4 Oil pressure pre-alarm (high temperature anticipatory).

1.3 Shop Drawings (Cont'd)

.2 Include:(Cont'd)

.15 (Cont'd)

.5 Water temperature pre-alarm (high temperature anticipatory).

.6 Low fuel (less than 2hrs)

.7 Low engine temperature(unreliable start).

.8 Low battery voltage.

.9 85% load.

.10 105% overload.

.5 Manual remote emergency stop.

1.4 Operation and Maintenance Data

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 01730.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch , battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.5 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 16990.

1.6 Training

.1 Contractor to conduct training program for designated maintenance personnel to allow system users to understand and exercise all aspects of system operation.

.2 Training program to be of 2-hour duration. Training period schedule to be established by the engineer. Training period to take place after building substantial completion and prior to building occupancy.

1.7 Safety Equipment

.1 Provide the following wall mounted safety equipment in the generator room:

.1 Portable Eyewash Station: portable eyewash with solution, 1 litre capacity, wall mount storage case.

.2 Hearing Protectors: External wear with adjustable head band, three pair, wall mounted on suitable hook beside door.

1.8 Source Quality Control

.1 Generator set to be factory tested including engine, alternator, control panels, transfer switch and accessories.

.2 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:

.1 Date.
.2 Generator set serial no.
.3 Engine, make, model, serial no.
.4 Alternator, make, model, serial no.
.5 Voltage regulator, make and model.
.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

1.8 Source Quality Control (Cont'd)

.3 Tests:

.1 With 100% rated load, operate set for 8 h, taking readings at 30 min intervals, and record following:

- .1 Time of reading.
- .2 Running time.
- .3 Ambient temp in °C.
- .4 Lube oil pressure in kPa.
- .5 Lube oil temp in °C.
- .6 Engine coolant temp in °C.
- .7 Exhaust stack temp in °C.
- .8 Alternator voltage: phase 1, 2, 3.
- .9 Alternator current: phase 1, 2, 3.
- .10 Power in kW.
- .11 Frequency in Hz.
- .12 Power Factor.
- .13 Battery charger current in A.
- .14 Battery voltage.
- .15 Alternator cooling air outlet temp.

.2 After completion of 8 h run, perform and document the following shut down devices and alarms:

- .1 Overcranking.
- .2 Overspeed.
- .3 High engine temp.
- .4 Low lube oil pressure.
- .5 Short circuit.
- .6 Alternator overvoltage.
- .7 Low battery voltage, or no battery charge.
- .8 Manual remote emergency stop.
- .9 High alternator temperature.
- .10 85% load alarm and contact open.
- .11 105% load alarm and contact closure.

.4 Test:

.1 Automatic starting of set and automatic transfer of load on failure of normal power.

.2 Manual operation of transfer switch.

.3 Automatic shut down of engine on resumption of normal power.

.4 That battery charger reverts to high rate charge after cranking.

1.8 Source Quality Control (Cont'd)

.5 Test low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

.6 Submit certified copy of test results to Consultant before shipment to site.

PART 2 - PRODUCTS

2.1 Diesel Engine

.1 Diesel engine: to ISO 3046/1.

.1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.

.2 Turbo charged, synchronous speed 1800 r/min.

.3 Capacity:

.1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows:

$$\text{Rated continuous output} = \frac{\text{Generator kW}}{\text{Generator Eff @ FL}}$$

.1 Under following site conditions:

.1 Ambient temperature: 40°C.

.2 Relative humidity: 60%.

.4 Cooling System:

.1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side, with ethylene glycol anti-freeze non-sludging above minus 46°C.

.2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40°C.

.3 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer

2.1 Diesel Engine (Cont'd)

.4 Cooling System: (Cont'd)

.3 Block heater: (Cont'd)

switch to allow engine to start in room ambient 0°C.

.1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.

.5 Fuel:

.1 No. 2, P50 diesel fuel oil.

.6 Fuel system: solid injection, mechanical fuel transfer pump with hand primer, fuel filters and air cleaner, fuel rack solenoid energized when engine running.

.7 Governor:

.1 Mechanical hydraulic with:

.1 Steady state speed band of plus or minus 0.5%.

.2 Speed regulation no load to full load 5% maximum.

.3 Electronic type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.25%.

.8 Lubrication system:

.1 Pressure lubricated by engine driven pump.

.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.

.3 Lube oil cooler.

.4 Engine sump drain valve.

.5 Oil level dip-stick.

.9 Starting system:

.1 Positive shift, gear engaging starter 24 V dc.

.2 Cranking limiter to provide 3 cranking periods of 10 s duration, each separated by 5 s rest.

.3 Lead acid, 24 V storage battery with sufficient capacity to crank engine for 1 min

2.1 Diesel Engine (Cont'd)

.9 Starting system:(Cont'd)
.3 (Cont'd)
at 0°C without using more than 25% of ampere hour capacity.
.4 Battery charger: constant potential type with manual and automatic control mounted adjacent to unit conplete with DC ammeter, volt meter, overload protection, AC input switch, pilot light for AC "on", equalizing charge and high rate charge. Unit to be capable of full charging discharged battery to 80% charge in 4 hours, 100% charge in 12 hours.

.10 Mechanical design has been based on the follwing criteria. Allow in contract price for any changes to mechanical design criteria to accommodate a particular generator manufacturer.
.1 Fuel consumption: 37.9 litre/hour at 100% load.
.2 Heat rejected to atmosphere from engine and alternator 1830 BTU/Min
.3 Combustion air minimum 11.1 cubic meters/minute
.4 Refer to Division 15 for other pertinent data.

.11 Vibration isolated engine instrument panel with:
.1 Lube oil pressure gauge.
.2 Lube oil temperature gauge.
.3 Coolant temperature gauge.
.4 Running time meter: non-tamper type.

.12 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.13 Drip tray.

.14 Standard of Acceptance: 75kW Caterpillar Diesel Generator Set, Model 3304 DINA

2.2 Alternator

.1 Alternator: to ANSI/NEMA MG1-1993.

.2 Rating: 3 phase, 347/600 V, 4 wire, 75 kW, 60 Hz, at 0.8 PF.

.3 Output at 40°C ambient:
.1 100% full load continuously.
.2 110% full load for 1 h.
.3 150% full load for 1 min.

.4 Revolving field, brushless, single bearing.

.5 Drip proof.

.6 Amortisseur windings.

.7 Synchronous type.

.8 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.9 Exciter: rotating brushless

.10 EEMAC class H insulation on windings.

.11 Alternator: capable of sustaining 300% rated current for period not less than 10 s permitting selective tripping of down line protective devices when short circuit occurs.

2.3 Control Panel

.1 Totally enclosed, mounted on generator with vibration dampers.

.2 Instruments:
.1 Analog indicating type 2% accuracy, rectangular face, flush panel mounting:
.1 Voltmeter: scale 0 to 1000V
.2 Ammeter: scale 0 to 500A
.3 Frequency meter: scale 55 to 65 Hz.
.2 Voltmeter selector switch, rotary, panel mounting, four position, labelled "Off-Phase A-Phase B-Phase C".
.3 Ammeter selector switch, rotary, maintained contacts, panel mounting, designed to prevent opening of current circuits, four

2.3 Control Panel (Cont'd)

.2 Instruments:(Cont'd)
.3 (Cont'd)
position labelled "OFF- Phase A-Phase B-Phase C".
.4 Instrument Transformers
.1 Potential-dry type for indoor use:
.1 Ratio: 600 to 120.
.2 Rating: 600 V, 60 Hz
.2 Current-dry type for indoor use:
.1 Ratio:to suit meters of control circuits.
.2 Rating: 208 V, 60 Hz
.3 Positive action automatic short-circuiting device in secondary terminals.

.3 Controls:
.1 Engine start button.
.2 Selector switch: Off-Auto-Manual
.3 Engine emergency stop button and provision for remote emergency stop button.
.4 Alternator output breaker:
.1 Circuit breaker: bolt-on, moulded case, temperature compensated for 40°C ambient, dual thermal-magnetic trip.
.5 Voltage control rheostat: mounted on the inside of the control panel to be screwdriver adjust type with locking nut.
.6 Operating lights, panel mounted:
.1 "Normal power" pilot light-green.
.2 "Emergency power" pilot light-red.
.3 Green pilot lights for alternator output breaker on and red pilot lights for breaker off.
.7 Solid state indicator lights for alarm with 1 set manually reset NO/NC contacts wired to terminal block for remote annunciation on:
.1 Low fuel level - red (2 hours reserve).
.2 Low battery voltage - red.
.3 Ventilation failure - red.
.4 Battery Charger fault lamp - red.
.5 Emergency stop lamp - red.
.6 Not in Auto lamp - red.
.7 85% load lamp - yellow.
.8 Oil pressure preealarm - yellow.(low oil pressure anticipatory)

2.3 Control Panel (Cont'd)

.3 Controls:(Cont'd)
.7 (Cont'd)
.9 Water temp prealarm - yellow.
.10 Low engine temperature - yellow. (unreliable start)
.11 High engine temperature - yellow.
.12 System ready - green.
.13 105% load lamp - red.
.8 Solid state controller for automatic shutdown and alarms with 1 set manually reset NO/NC contacts wired to terminal block for remote annunciation on:
.1 Engine overcrank - red.
.2 Engine overspeed -red .
.3 Engine high temperature - red.
.4 Engine low lube oil pressure -red .
.9 Lamp test button.
.10 Alarm horn and silencing switch as per ANSI/NFPA 110-1996.
.11 Provision for remote monitoring.

2.4 Automatic Transfer Switch

.1 See section 16301.

2.5 Steel Mounting Base

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.
.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

2.6 Exhaust System

.1 Heavy duty industrial mounted exhaust silencer with condensate drain, plug and flanged couplings.

2.6 Exhaust System (Cont'd)

.2 Heavy duty flexible exhaust pipe with flanged couplings as required.

.3 Fittings and accessories as required.

.4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

2.7 Fuel System

.1 See Division 15 fuel supply.

.2 Copperfeed and return lines, with flexible terminations at engine.

.3 Shut-off cock.

.4 Renewable cartridge filter.

.5 Fire valve.

.6 Isolating valves on lines serving auxiliaries.

.7 Low fuel level alarm for remote indication.

2.8 Cooling Air System

.1 Engine ventilating system:
.2 Room ventilation as per Division 15.

2.9 Finishes

.1 Apply finishes in accordance with Section 16010 - Electrical General Requirements.

.2 Alternator control cubicle: inside finish white, exterior to match engine and alternator.

.3 Supply 0.25 L of grey touch-up enamel.

2.10 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Control panel:
.1 Type B nameplates for controls such as alternator breakers and program selector switch.
.2 TYPE C nameplates for meters, alarms, indicating lights and minor controls.

2.11 Fabrication

.1 Shop assemble generating unit including:
.1 Base.
.2 Engine
.3 Alternator.
.4 Control panel.
.5 Battery and charger.
.6 Automatic transfer equipment.

PART 3 - EXECUTION

3.1 Installation

.1 Locate generating unit and install as indicated.

.2 Install fuel supply system as indicated.

.3 Install ventilating air duct system as indicated.

.4 Pipe muffler drains to nearest floor drain.

.5 Complete wiring and interconnections as indicated.

.6 Start generating set and test to ensure correct performance of components.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.2 Provide in tender price for testing and adjusting of unit on site.

.3 Provide fuel for testing and leave full tanks on acceptance.

.4 Demonstrate to the Consultant and Engineer:
.1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.
.2 Unit start and shut down on "Manual" control
.3 Unit start and transfer on "Test" control.
.4 Unit start on "Engine start" control.
.5 Operation of automatic alarms and shut down devices. Simulate conditions required, jumpering out of alarm or shutdown devices alone is not acceptable.

.5 Record the follwing on site in 20 minute intervals during four hour test and submit readings to Engineer. The Engineer or the Engineers representative is to be on site during testing.
.1 amps, L1, L2, L3.
.2 voltage, L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N.
.3 coolant temperature
.4 room temperature
.5 frequency
.6 Oil pressure.

.6 A manufacturers representative is not required on site.

.7 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

.8 At the end of test while diesel is still warm change oil, air filter, oil filter and fuel filter. Clean and repaint where required except for exhaust manifold.

1.1 Product Data .1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Transformers .1 Use transformers of one manufacturer throughout project.

.2 Design:
.1 Type: KT with K-rating of 4.
.2 3 phase, kVA as indicated on drawings, 600V input, 120/208V wye output, 60 Hz.
.3 Voltage taps: 2-2.5%
.4 Core: High grade, non aging, grain-oriented silicon with high magnetic permiability and low hysteresis and eddy current losses. The transformer core volume shall allow efficient transformer operation at 10% above nominal tap voltage. The core and coil assembly shall be installed on vibration-absorbing pads.
.5 Coil: High quality, electrical grade copper conductor with continuous wound construction. The neutral conductor shall be rated to carry 200% of normal phase current.
.6 Insulation: Class H 220C (Class 220 as per CSA winding insulation system). All insulation materials shall be flame retardant and shall not support combustion as defined in ASTM Standard Test Method D635.
.7 Basic Impulse Level (BIL): standard.
.8 Hipot: standard.
.9 Average sound level: 50dB
.10 Enclosure: EFC (formerly EEMAC) Type 2, ventilated, indoor, drip proof with removable metal panels.
.11 Mounting: floor.
.12 Finish: in accorance with section 16010 - Electrical General Requirements.

.3 Standard of acceptance: Rex Manufacturing, Hammond Manufacturing or approved equivalent.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with section 16010 - Electrical General Requirements.

.2 Label size: Type A, labelled as shown on the single line diagrams.

PART 3 - EXECUTION

3.1 Installation

.1 Mount dry type transformers on floor.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Make primary and secondary connections in accordance with wiring diagram.

3.2 Testing

.1 Each transformer shall be completely factory tested and the results certified, proving the performance of the units to provide capacities as listed in these specifications.

.2 After the transformers have been set in place on site, prior to energizing, verify in writing that the transformers have been installed and tested in accordance with recommended practice and are suitable for energizing and use. Without limiting the foregoing, the work shall, as a minimum, include the following:

.1 Prior to connecting, the contractor is to inspect visually and conduct the following tests:

.1 Megger insulation and correct reading to 20C base. Megger high voltage

3.2 Testing (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

to ground with secondary grounded for duration of the test. Megger low voltage to ground with the primary grounded for the duration of the test.

.2 Perform ratio test for all transformer tap positions.

.3 Verify the shipping braces and shipping shims have been removed.

.2 After the connection of line, load, and grounding wiring, but prior to energizing, the calibration and verification firm is to inspect the installation and confirm the following:

.1 That the transformer has been properly cleaned, is dry and free of foreign materials and contaminants and otherwise is suited for energizing.

.2 That all bus and connector bolts have been installed, tightened, torqued properly, and uninsulated surfaces of connectors and buses have been taped.

.3 That transformer taps have been set to provide the secondary voltage required.

.4 That all insulators are in perfect condition, without cracks, chips or surface contaminants.

.5 That core, coil, terminal boards, tap changers, bushings and all insulated surfaces have not been damaged.

.3 Any other tests or inspections deemed necessary or appropriate by the manufacturer.

END

PART 1 - GENERAL

1.1 References

.1 CAN3-C13-M83, Instrument Transformers.

.2 ANSI/NEMA ICS-2-1995 Edition Edition, Industrial Control Devices, Controllers, and Assemblies.

1.2 System Description

.1 Automatic load transfer equipment to:
.1 Monitor voltage on all phases of normal power supply.
.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase above or below preset adjustable limits for adjustable period of time.
.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.
.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on all phases within an adjustable pre-set range for adjustable time period.
.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay (may be eliminated if provided in generator controller).

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300.

.2 Include:
.1 Make, model and type.
.2 Single line diagram showing controls and relays.
.3 Description of equipment operation including:
.1 Automatic starting and transfer to standby unit and back to normal power.

1.3 Shop Drawings (Cont'd)

.2 Include:(Cont'd)
.3 (Cont'd)
.2 Test control.
.3 Manual control.
.4 Automatic shutdown.

1.4 Closeout Submittals

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01300 - Submittals.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:
.1 Schematic diagram of components, controls and relays.
.2 Illustrated parts lists with parts catalogue numbers.
.3 Certified copy of factory test results.

PART 2 - PRODUCTS

2.1 Materials

.1 Instrument transformers: to CAN3-C13-M83.

.2 Contactors: to ANSI/NEMA ICS-2-1995 Edition Edition.

2.2 Contactor Type Transfer Equipment

.1 Three-pole contactors mounted on common frame, in double throw arrangement, electrically and mechanically interlocked, solenoid operated, with CSA 1 enclosure.

.2 Rated: 600 V, 60 Hz, 400 A. 4 wire, solid neutral.

.3 Main contacts: silver surfaced, protected by arc disruption means.

2.2 Contactor Type Transfer Equipment (Cont'd)

.4 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance.

.5 Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power.

.6 Fault withstand rating: 22 kA symmetrical for 3 cycles with maximum peak value of 31 kA.

.7 Both line-side and generator-side contactors are to be mechanically held.

.8 Contactors to be rated for 100% duty and interruption of inductive loads with 0.7 pf or greater.

.9 Solid neutral bar, rated 400 A.

2.3 Controls

.1 Selector switch - two position "Test", "Auto".
.1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
.2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.2 Control transformers: dry type with 120 V secondary to isolate control circuits from:
.1 Normal power supply.
.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
.1 Voltage sensing: all phases for normal power and on one phase only for stand-by, solid state type, adjustable drop out and pick up, close differential, 2 V minimum undervoltage and overvoltage protection.
.2 Time delay: normal power to standby, adjustable solid state, 0 to 60 s.

2.3 Controls (Cont'd)

.3 Relays:(Cont'd)

.3 Time delay on engine starting to override momentary power outages or dips, adjustable 0 to 60 s delay.

.4 Time delay on retransfer from standby tc normal power, adjustable 5 to 300 s.

.5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable 20 s intervals to 10 min (not required if part of engine control system).

.6 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

2.4 Accessories

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel door.

.2 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote alarms.

2.5 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Control panel:

.1 For selector switch and manual switch: Type B nameplates.

.2 For meters, indicating lights, minor controls: Type B nameplates.

.3 For description, voltage and ampacity of equipment: Type A nameplates.

.4 Nameplates to include: "Auto - Test" - for switch. "Normal Power" - for green indicator light. "Stand-by Power" - for red indicator light.

2.6 Source Quality Control

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Consultant.

.2 Tests:

.1 Operate equipment to ensure proper performance.

.2 Check selector switch, in all modes of operation Test, Auto and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

PART 3 - EXECUTION

3.1 Installation

.1 Locate, install and connect transfer equipment.

.2 Check relays and adjust as required.

.3 Install and connect battery.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Auto" position and open normal power supply disconnect. Standby

3.2 Field Quality Control (Cont'd)

.4 (Cont'd)
should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

END

PART 1 - GENERAL

1.1 References

.1 CSA C83-96 Communication and Power Line Hardware.

1.2 Co-ordination with Power Supply Authority

.1 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required. Costs levied by utility companies are to be paid from cash allowances Section 01020.

PART 2 - PRODUCTS

2.1 Material

.1 Service conduit: electrical metallic tubing, weatherhead.

.2 Service conduit support devices.

.3 Insulator rack: to CSA C83-96, four wire, heavy duty capable of supporting utility cable drop.

.4 Weatherhead: to approval of supply authority.

.5 Electrical metallic tubing, necessary fittings: to Section 16111 - Conduits, Conduit Fastenings and Conduit Fittings.

.6 Service conductors from utility connection point: to Section 16122 - Wires and Cables 0-1000 V, copper, type RW90 XLPE, size and number of conductors as indicated.

.7 Meter socket: to approval of supply authority seven jaw type. Locate meter in EEMAC 3 enclosure with hinged, gasketted door and provision for padlocking.

PART 3 - EXECUTION

3.1 Installation

.1 Install service conduits, insulator rack, weatherhead.

.2 Install service drop conductors allowing adequate conductor length for connection to service equipment.

.3 Allow adequate conductor length for connection to supply by power supply authority.

.4 Allow adequate conductor length for drip loops.

.5 Make grounding connections in accordance with Section 16450 - Grounding - Secondary.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.2 Perform additional tests if required by authority having jurisdiction.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Disconnect Switches

.1 Disconnect switch in CSA Enclosure 1 or 4 as required, size as indicated.

.2 Provision for padlocking in on-off off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

.6 Horsepower rated for load interruption.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate name of load controlled on Type B nameplate.

PART 3 - EXECUTION

3.1 Installation .1 Install disconnect switches connect feeders.

END

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 Equipment

.1 Ground Grid connect to artificial grounding electrode as indicated on drawings.

.2 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, type TWH.

.4 Ground bus: copper, size 55.0 mm by 6.0 mm by 1219 mm, complete with insulated supports, fastenings, connectors.

.5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit and make secure electrical connection between conduit and ground wire with ground hub.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

3.1 Installation General (Cont'd)	.4	Make buried connections, and connections to electrodes, using copper welding by thermit process permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837-1988.
	.5	Use mechanical connectors for grounding connections to equipment provided with lugs.
	.6	Soldered joints not permitted.
	.7	Install bonding wire for flexible conduit, connected at both one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
	.8	Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
3.2 Electrodes	.1	Use electrode components and copper conductors and sized as on drawings.
3.3 Equipment Grounding	.1	Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, distribution panels, all metallic mechanical piping systems.
3.4 Grounding Bus	.1	Install copper grounding bus mounted on insulated supports on wall of mezzanine.
3.5 Communication Systems	.1	Install grounding connections for telephone system as follows: .1 Telephone 1 #6 TWH to telephone and cable TV service conduit.

3.6 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

END

PART 1 - GENERAL

1.1 Related Work	.1	Plywood Backboard:	Section 06100 Rough Carpentry
1.2 Shop Drawings	.1	Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.	
	.2	Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.	
1.3 Plant Assembly	.1	Install circuit breakers in panelboards before shipment.	
	.2	In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.	

PART 2 - PRODUCTS

2.1 Panelboards	.1	Panelboards: product of one manufacturer.
	.2	250 V panelboards: bus rated for 25,000 A (symmetrical) fault withstand capacity or as indicated. 120/208 volt, 3 phase, 4 wire, solid neutral design with sequence style bussing and full capacity neutral of capacity indicated.
	.3	Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
	.4	Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

2.1 Panelboards (Cont'd)

.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim and door finish: air dried grey enamel.

.9 Cutler-Hammer Pow-R-Line 1, Square D type NQOB, Siemens type NLAB.

2.2 CDP Panelboards

.1 Panelboards: product of one manufacturer.

.2 600 V panelboards: bus rated for 25,000 A (symmetrical) fault withstand capacity or as indicated. 347/600 volt, 3 phase, 4 wire, solid neutral design with sequence style bussing and full capacity neutral of capacity indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Copper bus with neutral of same ampere rating as mains.

.6 Mains: suitable for bolt-on breakers.

2.3 Breakers

.1 Breakers: to Section 16477 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.3 Breakers (Cont'd)

.3 Lock-on devices for emergency lights and exit lights circuits.

2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Nameplate for each panelboard Type B engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards Type B engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location of each circuit.

PART 3 - EXECUTION

3.1 Installation

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 16010 - Electrical General Requirements or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus.

.6 Mount panelboard vertically with odd numbered breaker on the left and even numbered breakers on the right.

.7 Wherever possible use pull boxes to collect home runs and larger conduits to complete the return to the branch circuits to avoid conduit congestion at the face of walls.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

.2 Include time-current characteristic curves for breakers with ampacity of 200 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 - PRODUCTS

2.1 Breakers General

.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Minimum interrupting capacity of 10,000 Amps (symmetrical) except where otherwise indicated.

2.2 Breakers CDP

.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Single or multi-pole breakers as indicated on the drawings.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

2.2 Breakers CDP (Cont'd)	.4	Minimum interrupting capacity of 22,000 Amps (symmetrical) except where otherwise indicated.
2.3 Thermal Magnetic Breakers Design A	.1	Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

PART 3 - EXECUTION

3.1 Installation	.1	Install circuit breakers as indicated.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 16010- - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Contactors

.1 Contactors: to EEMAC No.1CS-1970.

.2 Mechanically held or electrically held (as indicated on drawings), controlled by pilot devices and rated for type of load controlled. Half size contactors not accepted.

.3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in CSA Enclosure 1 unless otherwise indicated.

.5 Include following options in cover:
.1 Red LED indicating lamp illuminated when contactor is closed. Provide Type B label.
.2 Selector or control switches as indicated on drawings.

.6 Suitable for interruption of motor loads at rated current.

.7 Electrically held units to be suitable for continuously energized coil operation.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Type A nameplate indicating name of load controlled as indicated.

PART 3 - EXECUTION

3.1 Installation .1 Install contactors and connect auxiliary control devices.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Engineer.

.3 Photometric data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE type, coefficient of utilization, lamp type, and lumen rating in accordance with IESNA testing procedures.

PART 2 - PRODUCTS

2.1 Lamps

.1 Fluorescent lamps.

Lamp Design	Lamp shape Wattage	Base	Initial Lumens	Life h	CCT	CRI
2A	T8-32/1219mm	md.B1p	2950	20,000	3,500K	80

To be CGE Trimine F32T8 SPX35/RS or OSRAM Octron F032/835.

2.2 Ballasts

.1 Fluorescent Ballast:. 120 V, electronic type, harmonic distortion less than 20%, power factor greater than 0.97, crest factor less than 1.7 to be General Electric/ Motorola G2-RN-T8-1LL-120 or Osram system 32 GT2X32/120IS.

.2 High Intensity discharge ballasts: 120 volt design, single lamp of the constant wattage high power factor type. Start-up current to be not greater than 110% of full load running current.

2.3 Finishes

.1 Baked enamel finish:

.1 Conditioning of metal before painting:

.1 For corrosion resistance conversion coating to CGSB 31-GP-103M.

.2 For paint base, conversion coating to CGSB 31-GP-105M, CGSB 31-GP-106a.

.2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel polyester powdercoat alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.

.3 Reflector and other inside surfaces finished as follows:

.1 White, minimum reflection factor 85%.

.2 Colour fastness: yellowness factor not above 0.02 and after 250 h exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60° gloss meter.

.5 Flexibility: withstand bending over 12mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

.2 Alzak finish:

.1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:

.1 Finish for mild commercial service, minimum density of coating 7.8 g/m^2, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.

.2 Finish for regular industrial service, minimum density of coating 14.8 g/m^2, minimum reflectivity 82% for specular and 73% for diffuse.

2.3 Finishes (Cont'd)

.2 Alzak finish:(Cont'd)
.1 (Cont'd)
.3 Finish for heavy duty service, minimum density of coating 21.8 g/m^2, minimum reflectivity 85% for specular, 65% for diffuse.

2.4 Light Control Devices

.1 Design.
.1 Lens thickness: 2.41 mm minimum or as indicated.
.2 Material: injection moulded clear virgin acrylic prismatic glass opal glass open parabolic aluminum deep cell parabolic aluminum.
.3 Light distribution:.
.4 Treatment: ultraviolet inhibited.
.5 Overlay: material, mm thick, colour, ultraviolet filter.
.6 Frame: hinged gasketted latched die cast spring loaded rigid extruded steel aluminum.
.7 Type: reflector refractor.

2.5 Luminaire Schedule

.1 Type 200: 1219 mm long, 2/32 Watt, strip fluorescent c/w wire guard. Surface or chain suspended, as indicated on drawings. Metalux

.2 Type 300: Wall mounted, 70W high pressure sodium fixture c/w die cast aluminum housing, polycarbonate lens. Lumark Wal-Pak HPWL-70 or Holophane Wallpack II WL2K-070HP

.3 Type 301: 175 Watt metal halide, low bay, pendant mount. Lumark MHEP-R22-175

PART 3 - EXECUTION

3.1 Installation

.1 Locate and install luminaires as indicated.

3.2 Wiring

.1 Connect luminaires to lighting circuits:
.1 Bx may be used for drops to fixtures.

3.3 Luminaire Supports

.1 Support fluorescent luminaires mounted in continuous rows once every 1.219 m.

3.4 Luminaire Alignment

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END

PART 1 - GENERAL

1.1 Product Data .1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Exit Lights - General .1 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.

.2 Face and back plates: cast aluminum alloy.

.3 Lamps: Light Emitting Diodes LED.

.4 Designed for 25 year life expectancy.

.5 Letters: 150 mm high red on die-cast aluminum face plate, reading EXIT.

.6 To have DC voltage option.

.7 To have 5 year warranty.

.8 Ceiling and surface mounting.

.9 Single or Double face with die-cast face plate to remain captive for relamping.

.10 Arrow: as required.

.11 To be Lumacell model LER 400 series or EMERGI LITE EM LPEX50.

PART 3 - EXECUTION

3.1 Installation

.1 Install exit lights as indicated, in accordance with NBC-1995.

.2 Connect fixtures to exit light circuits as indicated.

.3 Connect all fixtures to emergency circuits.

.4 Ensure that exit light circuit breaker is locked in on position.

.5 Exit light circuits are to contain no other electrical loads.

END

PART 1 - GENERAL

1.1 System	.1	Complete battery operated emergency lighting system as described herein and on the drawings to meet National Building Code standards.
1.2 Shop Drawings and Product Data	.1	Submit shop drawings and product data in accordance with Section 16010 - Electrical General Requirements.
	.2	Battery charge and discharge voltage/time characteristics.
1.3 Operation and Maintenance Data	.1	Submit operation and maintenance data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 System	.1	Central system rated at 24 V dc with installed battery capacity of 360 W for 30 min and to produce not less than 91% of nominal dc system voltage with ac supply 'off'.
2.2 Battery Charger	.1	Input: 120 VAC, 60 Hz.
	.2	Output: 24 volt dc minimum, 5 circuit fuse distribution box.
	.3	Automatically maintain battery in fully charged state while main power available. Maintain dc float voltage within plus or minus 1% of setting, no load to full load, during main voltage variations of plus 10% to minus 10% and frequency variations of plus or minus 5%.

2.2 Battery Charger (Cont'd)	.4	Equalize charging rate such that after battery has provided full power output for specified duration, charger returns battery to 95% of fully charged state in 12 h.
	.5	Automatic cycle test providing 12 discharges per year.
2.3 Batteries	.1	Long life sealed lead battery 10 year maintenance free life expectancy.
2.4 Auxiliary Equipment	.1	Control panel containing: .1 Ammeter. .2 Voltmeter. .3 Test switch. .4 AC input and dc output inside cabinet. .5 Brownout protector. .6 Low voltage disconnect. .7 Standard 120 volt input voltage line cord.
2.5 Cabinet	.1	Suitable for direct or shelf mounting to wall and complete with knockouts for conduits. Removable or hinged front door for easy access to batteries.
	.2	Finish: tan.
2.6 LED Indicators and Audible Alarms	.1	Amber LED: unit ready and trouble free (flashing); charging mode failure (on); master card failure (off).
	.2	Green LED Test in progress: delay TDR; equalize mode.
	.3	Red LED: battery low.
	.4	Audible alarm: Any failure shall be followed by a pulsating audible alarm on for 3 seconds

2.6 LED Indicators and Audible Alarms (Cont'd)

.4 Audible alarm:(Cont'd) every two and one half minutes (2 1/2) until the failure is repaired.

2.7 Wiring

.1 Conduit: EMT type, to Section 16111 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: type RW90, to Section 16122 - Wires and Cables 0-1000 V, size to be #10 AWG minimum.

2.8 Fixtures

.1 Lamp heads: adjustable mounting, swivel type, c/w tungsten, 9W, 24V, glare free, and minimum 800 lumen output lamps. Provide wire guards to remote heads in the gymnasium. Single or double heads - to be Lumacell MT series or Emergi-Lite EF9 series.

2.9 Standard of Acceptance

.1 Lumacell RGS245-360-2MT-AT-DPF5-V-A or Emergi-Lite 24ESL360-2MAC-FB6-V-A (use 360 W units where indicated on drawings)

PART 3 - EXECUTION

3.1 Installation

.1 Identify conductors for polarity and voltage.

.2 Install central and remote heads as indicated on drawings and make all required connections to heads and exit lights.

.3 Direct light heads to suit site condition and check operation.

.4 Install with conductors sized to maintain current flow with maximum 3% voltage drop.

3.2 Field Quality Control	.1	Perform tests in accordance with Section 16010 - Electrical General Requirements.

—— END

PART 1 - GENERAL

1.1 Product Data .1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Photoelectric Lighting Control

.1 Wall individual mounted.

.2 Capable of switching 1800 W of lighting at 120 V.

.3 Voltage variation: plus or minus 10%.

.4 Temperature range: minus 40°C to plus 40°C.

.5 Switching on lights at owners determination.

.6 Switching off lights at owners determination.

.7 Rated for 5000 operations.

.8 Options:
.1 Twist-lock type receptacle.

.9 Switching time delay of 30 s.

.10 Wall mounting bracket.

.11 Colour coded leads: size 10 AWG, 460 mm long.

2.2 Selection Switch .1 3 position load rated contactor connect in parallel with photoelectric cell.

2.3 Standard of Acceptance

.1 Keene P400-A with P400-R twist-lock receptacle base or approved equivalent.

PART 3 - EXECUTION

3.1 Installation

.1 Install photoelectric controls in accordance with manufacturer's instructions.

.2 Photo-electric cell to control all exterior building mounted luminaires.

.3 The selector switch positions to be "ON", "OFF" and "AUTO". "ON" position bypass photoelectric cell. Provide Type C labels for position indicators.

.4 Mount selector in face of enclosure and label position.

END

PART 1 - GENERAL

1.1 Materials

.1 Alarm devices as described and supplied under Division 15.

.2 Solid state 120V AC, Amber strobe light for mechanical alarm panel. Unit to be Simplex 200B (special design for arctic weather condition) amber alarm strobelight for pipe mounting or approved equivalent. Electronics for strobe light to be remote mounted inside warm area of building.

.3 Weatherproof surface wall mounted single projector type siren for 24 volt DC operation. Unit to be Simplex 2901-9842 or approved equivalent.

1.2 Installation

.1 Provide necessary wiring and connections from Mechanical Division 15 control panel supplied under Division 15. To alarm on mechanical alarms as determined under Division 15.

.2 Division 15 to supply relay contact in mech. control panel which is normally open and closes on alarm. Electrical to provide all wiring required to make system functional.

.3 Locate amber light as indicated on drawings.

.4 Division 16 to provide any tranformers or relays required for operational system.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Electrical General Requirements.

1.2 Operation and Maintenance Data

.1 Submit operation and maintenance data in accordance with Section 01300 - Electrical General Requirements.

1.3 Digital Voice Autodialer System

.1 Provide conduit, wire, switches, etc. to install Division 15 supplied mechanical control panel.

.2 Each of the following systems shall activate separate autodialer channels with separate phone numbers and separate messages:
.1 Mechanical Alarm

PART 2 - PRODUCTS

2.1 Digital Voice Autodialer

.1 Mechanical alarm panel, refer to Division 15.

.2 Provide autodialer with the following features:
.1 Solid state, user programmable, voice message recording and playback. Not to utilize mechanical tape mechanisms.
.2 Number of message repetitions adjustable from 2-4-8.
.3 Each channel to be capable of being individually configurable for alarm on "contacts close", "contacts open" or "no alarm."
.4 Operable on both touch-tone and rotary-dial, standard telephone lines.
.5 Message length of 42 seconds.

2.1 Digital Voice Autodialer (Cont'd)

.2 (Cont'd)
.6 Autodialer to be 4-channel Delta Vox Dialex 4500 or approved equivalent.

.3 Provide 4 amp/hr battery for use with autodialer.

.4 Provide 120V/12 volt transformer with minimum of 250 mA output at 12 volts for use with autodialer.

PART 3 - EXECUTION

3.1 Operation of Digital Voice Auto Dialer

.1 Provide all necessary wiring and auxiliary relays to mechanical control panel.

END

PART 1 - GENERAL

1.1 References

.1 CAN/ULC-S524-M91 Installation of Fire Alarm Systems

.2 ULC-S525-1978 Audible Signal Appliances, Fire Alarm

.3 CAN/ULC-S527-M87(R1995) Control Units, Fire Alarm

.4 CAN/ULC-S528-M91 Manually Actuated Signalling Boxes, Fire Alarm

.5 CAN/ULC-S529-M87(R1995) Smoke Detectors, Fire Alarm

.6 CAN/ULC-S530-M91 Heat Actuated Fire Detectors, Fire Alarm

.7 CAN/ULC-S536-1997 Inspection and Testing of Fire Alarm Systems

.8 CAN/ULC-S537-1997 Verification of Fire Alarm Systems

.9 DFC No. 410(M) Fire Alarm Systems

.10 NBC National Building Code of Canada

1.2 Description of System

.1 Supervised, non-coded, 24VDC, fully addressable, annunciated and zone partitioned.

.2 System includes:

.1 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating single-stage alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.

.2 Trouble signal devices.

.3 Power supply facilities.

.4 Manual alarm stations.

1.2 Description of System (Cont'd)

.2 System includes:(Cont'd)
.5 Automatic alarm initiating devices.
.6 Audible signal devices.
.7 End-of-line devices.
.8 Annunciators.
.9 Visual alarm signal devices.
.10 Anciliary devices. Spare contacts for autodialers and air handling units.

1.3 Requirements of Regulatory Agencies

.1 System:
.1 To Nunavut Fire Marshal approval.
.2 To Nunavut Fire Marshal final acceptance.

.2 System components: listed by ULC, bear the ULC label and comply with applicable provisions of National Building Code, Local/Provincial Building Code, CAN/ULC-S524-M91 standard for the installation of fire alarm systems, Canadian Electrical Code C22.1; part I and meet requirements of local authority having jurisdiction.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.

.2 Include:
.1 Layout of equipment.
.2 Zoning.
.3 Complete wiring diagram, including schematics of modules.

.3 Shop drawings to be stamped by manufacturer to ensure equipment/design is in accordance with ULC standards.

1.5 Operation and Maintenance Data

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 16010 - Electrical General Requirements.

.2 Include:
.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
.2 Technical data - illustrated parts lists with parts catalogue numbers.
.3 Copy of approved shop drawings.
.4 Certificate of verification.

.3 NOTE: photostatic copies of manuals or drawings shall not be accepted. Manuals to contain information applicable only to the system covered in these documents.

1.6 Maintenance Materials

.1 Include:
.1 10 spare break-glass rods for manual pull box stations if applicable.

PART 2 - PRODUCTS

2.1 Materials

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524-M91.

.3 Audible signal devices: to ULC-S525-1978.

.4 Control unit: to CAN/ULC-S527-M87(R1995).

.5 Manual fire alarm stations: to CAN/ULC-S528-M91.

.6 Thermal detectors: to CAN/ULC-S530-M91.

.7 Smoke detectors: to CAN/ULC-S529-M87(R1995).

2.2 System Operation .1 Single stage operation. Operation of any alarm initiating device to:
.1 Cause audible signal devices to sound throughout building.
.2 Transmit signal to central monitoring station via autodialers. Number to be provided by owner and programmed by this division.
.3 Cause zone of alarm device to be indicated on annunciators.
.4 Cause air handling fans to shut down.
.5 Cause door hold open devices to power down (close).

2.3 Control Panel .1 Class A, fully addressable.

.2 Single stage operation.

.3 Zoned.

.4 Non-coded.

.5 Enclosure: CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.

.6 Supervised, modular design with plug-in modules:
.1 Alarm receiver with trouble and alarm indications provision for remote supervised annunciation, for class A initiating circuit.

.7 Components:
.1 Alarm receiver panel with trouble and alarm indications for class A initiating circuit.
.2 Audible signal control panel with initiating control circuits complete with terminals for wiring and 2 plug-in modules for dc signals up to 2.0 A load with trouble indication with class B connections.
.3 Common control and power units:
.1 Control panel containing following indications and controls:

2.3 Control Panel (Cont'd)

.7 Components: (Cont'd)

.3 Common control and power units: (Cont'd)

.1 "Power on" LED (green) to monitor primary source of power to system.

.2 "Power trouble" indication.

.3 "Ground trouble" indication.

.4 "Remote annunciator trouble" indication.

.5 "System trouble" indication.

.6 "System trouble" buzzer and silence switch c/w trouble resound feature.

.7 System reset switch.

.8 "LED test" switch if applicable.

.9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.

.2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.

.4 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.

.1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.

.8 Standard of Acceptance:

.1 Edwards EST-2 or Notifier EFP-400 or equivalent.

2.4 Annunciators

.1 Contractor to install zoned graphic annunciator with zones matching those from the fire alarm remote annunciator display. Install drawing behind plexiglass and frame at front entrance. Main fire alarm control panel to be located in Electrical Room as shown on drawings. Contractor to install remote annunciator at main entance.

2.5 Power Supply

.1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of gel cell batteries minimum expected life of 5 years, sized to operate system under supervisory load conditions without recharging for 24 consecutive hours and have sufficient power left to operate sounding devices for 30 minutes. Battery bank and charger to be integrally mounted in main fire alarm control panel.

2.6 Manual Alarm Stations

.1 Manual alarm stations: Addressable pull lever, glass rod, wall mounted semi-flush type, non-coded single pole normally open contact for single stage initiation English signage.

2.7 Automatic Alarm Initiating Devices

.1 Heat detectors, addressable fixed temperature, non- restorable, rated 57°C or 93°C as indicated on drawings.

.2 Thermal fire detectors, addressable, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C, rate of rise 8.3°C per minute.

.3 Smoke detector: Addressable, ionization type.
.1 Plug-in type with fixed base.
.2 Wire-in base assembly with integral red alarm LED, and terminals for remote relay alarm LED.

.4 Duct Smoke Detector: Addressable, photo-electric type, air duct type with sampling tubes and protective housing.
.1 Twist-in type with fixed base.
.2 Wire-in base assembly with integral red alarm LED, and terminals for remote relay alarm LED.

2.8 Audible Signal Devices

.1 Bells: surface mounted, single stroke, polarized, 24 V dc, 250 mm, 90 db.

2.9 Remote Signal Circuit Power Supply

.1 Remote signal circuit power supply for accommodating up to four additional signal circuits. Power suppy to communicate with fire alarm control panel via addressable loop.

2.10 End-of-line Devices

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open , short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel.

2.11 Ancillary Devices

.1 Remote relay unit to initiate fan shutdown and door releases.

.2 Provision for remote relay unit to initiate autodialer for both alarm and trouble conditions.

2.12 Sprinkler System

.1 Connect all sprinkler flow switches to the respective box circuits wired to sound alarm in the event of the sprinkler's operation.

.2 Connect all sprinkler gate valve(s) to sound trouble if the valve is closed. Gate valves to be wired in the circuit such that singalling trouble will not prevent an initiating device from sending an alarm signal to the fire alarm panel.

.3 Sprinkler supervised valve switches, and flow switches to be provided by Division 15.

2.12 Sprinkler System (Cont'd)

.4 Refer to mechanical shop drawings for locations prior to rough-in.

.5 Provide multiplexing modules at each sprinkler device location to allow individual addressing of device on to fire alarm system loop.

PART 3 - EXECUTION

3.1 Installation

.1 Install systems in accordance with CAN/ULC-S524-M91.

.2 Install main control panel and connect to ac power supply, dc standby power. Mount control panel such that top of edge is at 1800 mm above finished floor.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring. Mount at 1350 mm above finished floor.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to main control panel.

.6 Locate and install bells,and visual signal devices and connect to signalling circuits. Mount bells at not less than 2100 mm above floor level.

.7 Connect signalling circuits to main control panel.

.8 Install end-of-line devices at end of alarm and signalling circuits in main panel except for signal circuits.

3.1 Installation (Cont'd)

.9 Locate and install remote relay units to control fan shut down.

.10 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.11 Provide 21 mm conduit and wiring to telephone autodialer location and tie-in to a separate channel of dialer. Verify operation. Refer to Section 16704.

.12 Provide 21 mm conduit and wiring to nearest low voltage lighting control panel and make connections to allow all low voltage controlled lighting to switch on with an alarm condition.

3.2 System Verification

.1 Fire alarm equipment supplier to make thorough inspections of the complete installed fire alarm system including all components such as manual stations, thermal detections, products-of-combustion detectors, and controls to ensure the following:

.1 Verfications are completed at the stages of construction noted in Section 16010 at each time and prior to occupancy of the various sections of the building.

.2 System is complete and functional in accordance with engineer's specifications.

.3 System is installed according to Underwriters Lab of Canada S524-M1991 requirements.

.4 System is installed in accordance with manufacturer's recommendations.

.5 Regulations covering supervision of components are adhered to.

.6 Subsequent changes necessary to conform to Items 1, 2, 3 and/or 4 to be done by Division 16 with technical assistance supplied by the manufacturer.

.7 During the period of this inspection by the manufacturer, Division 16 to supply to the manufacturer one journeyman electrician.

3.2 System Verification (Cont'd)

.1 (Cont'd)

.8 To assist Division 16 in preparing his bid, manufacturer to specify number of hours required to perform this inspection.

.9 Manufacturer to submit to engineer on completion of inspection a point-by-point check list indicating date and time of each item inspected and also issue a Certificate for his records confirming that inspection has been completed and system is installed and functioning in accordance with the specifications. Included with this Certificate to be satisfactory proof of libility insurance valid for not less than one (1) year from date of final inspection.

.10 Certificate to be free from defining and qualified statements which would make it unacceptable by the Owner.

.11 System verification to be conducted in the presence of the engineer and/or his representative and also in presence of the owner's representative.

.12 Notify Engineer of verification date and time at least one week in advance.

.13 Verification may be performed only after:

.1 Air balancing is complete.

.2 Sprinkler system is 100% complete, charged and ready for use.

.3 Building is at a state of completion that will ensure a reasonably dust free environment and the absence of contaminating fumes from verification date to final completion.

.14 Manufacturer to provide sufficient backup parts on site during verification to accommodate any component failures. Backup parts not used during verification can be removed from site by the manufacturer. Recommended back-up parts list:

-10 breakglass rods
- 5 heat detectors
- 1 duct detector
- 2 breakglass stations
- 2 fire alarm gongs
- 1 outdoor horn
- 5 spare alarm zone cards

3.2 System Verification (Cont'd)

.1 (Cont'd)

.14 (Cont'd)

- 2 spare trouble zone cards
- 2 spare signal zone cards
- 5 appropriate sized fuses
- 1 CPU programming chip (if applicable)
- any additional parts pertinent to the particular manufacturer that may possibly fail resulting in an incomplete verification.

.15 Provide two handheld two-way voice communication radios during verification.

3.3 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements and CAN/ULC-S537-1997.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors sprinkler system transmit alarm to control panel and actuate first stage alarm general alarm ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of trouble signals.

.4 Simulate and test all auxiliary functions.

.5 Test to be performed by the system manufacturer or qualified testing company, certified to test fire alarm system within Nunavut.

.6 Pay for all testing costs, excluding those of the electrical consulting engineer.

END

PART 1 - GENERAL

1.1 Related Work	.1	Plywood backboard:	Section 06100 Rough Carpentry
1.2 Description of System	.1	Incoming telephone service overhead from utility distribution pole.	
1.3 Co-ordination with Telephone Authorities	.1	Co-ordinate with telephone authority to ensure availability of service.	

PART 2 - PRODUCTS

2.1 Material	.1	Conduit: EMT Type, to Section 16111 - Conduits, Conduit Fastenings and Conduit Fittings.

PART 3 - EXECUTION

3.1 Installation	.1	Install telephone service facilities.
	.2	Install 19 mm thick plywood backboard as indicated on drawings.
	.3	Install grounding facilities and make connections.
	.4	Install service conduit on building for overhead service.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate:
- .1 Mounting method and dimensions.
- .2 Starter size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

1.2 Operation and Maintenance Data

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 16010 - Electrical General Requirements.

.2 Include operation and maintenance data for each type and style of starter.

PART 2 - PRODUCTS

2.1 Materials

.1 Starters: EEMAC E14-1.
- .1 Half size starters not acceptable. IEC sizing allowed for MCC.

2.2 Manual Motor Starters

.1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
- .1 Switching mechanism, quick make and break.
- .2 One overload heaters, manual reset, trip indicating handle.

.2 Accessories:
- .1 Toggle switch: standard or key operated as indicated.

2.2 Manual Motor Starters (Cont'd)

.2 Accessories: (Cont'd)
.2 Indicating light: standard red pilot light.
.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 Full Voltage Magnetic Starters

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
.1 Contactor solenoid operated, rapid action type.
.2 Motor overload protective device in each phase, manually reset from outside enclosure.
.3 Power and control terminals.
.4 Wiring and schematic diagram inside starter enclosure in visible location.
.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
.6 Hand-off-auto switch in enclosure door.
.7 Motor overload devices are to be electronic, self powered, non-thermal type with current sensing, 3:1 current range adjustment, phase unbalance and phase loss protection, harmonically insensitive, ambient insensitive with visible trip indication.

.2 Combination type starters to include motor circuit interrupter circuit breaker with operating lever on outside of enclosure, to control and disconnect motor circuit interrupter circuit breaker, and provision for:
.1 Locking in "OFF" position with padlocks.
.2 Locking in "ON" position.
.3 Independent locking of enclosure door.
.4 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:
.1 Selector switches: oil tight labelled as indicated.
.2 Indicating lights: LED Type in Red cover.
.3 Two sets of (NO) normally open auxillary contacts in addition to the standard auxillary holding contacts supplied with each contacter. One set of auxillary contacts convertable to normally closed (NC).

2.4 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and required secondary voltage, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 Finishes

.1 Apply finishes to enclosure in accordance with Section 16010 - Electrical General Requirements.

2.6 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical - General Provisions.

.2 Manual starter designation label, white plate, black letters, Type A, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size engraved as indicated.

PART 3 - EXECUTION

3.1 Installation

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 Tests

.1 Perform tests in accordance with Section 16010 - Electrical - General Provisions and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

3.2 Tests (Cont'd)	.4	Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END

PART 1 - GENERAL

1.1 Scope

.1 Provision of spare parts, devices and components as indicated herein.

PART 2 - PRODUCTS

2.1 Lamps

.1 Thirty (30) spare 32 Watt T8 lamps.

.2 Ten (10) spare 175 Watt metal halide lamps.

.3 Five (5) spare 70 Watt high pressure sodium lamps.

2.2 Ballasts & Accessories

.1 Five (5) spare two-lamp fluorescent ballasts.

.2 Two (2) spare 70 Watt high pressure sodium ballasts.

.3 Two (2) spare 175 Watt metal halide ballasts.

2.3 Motor Starters

.1 Three (3) spare fuses of each type and size used.

.2 One(1) set of each type of adjustable thermal overload device.

.3 One (1) spare coil of each starter size.

.4 Two (2) spare control transformers.

2.4 Strobes

.1 Two (2) spare lamps for each voltage of strobe light.

.2 One spare amber strobe lens.

PART 3 - EXECUTION

3.1 Verification

.1 All parts listed to be assembled at one location at the time of interim inspection for verification by Engineer and building maintainer.

.2 Prepare typewritten list of all spare parts provided and present at time of inspection for witnessing and signature by building maintainer. One copy of signed list to be included in each copy of O & M Manuals.

END